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ABSTRACT

This guide is intended to draw attention to the necessity for safety education in every aspect of industrial arts and to provide resources for upgrading and improving safety instruction in the classroom. It also can be used for inservice training of industrial art teachers and for undergraduate teacher education in Connecticut. Introductory materials include a suggested safety education policy statement and discussion of specific guidelines for Industrial Arts. Other materials contained in the guide fall into these 10 categories: Safety Responsibilities, Safety Program Administration, Personal Safety Practices, Safety Practices in Industrial Arts, First Aid, General Building/Shop Electical Wiring, Occupational Safety and Health Act (OSHA) Machine Guarding Requirements, Specific Safety Considerations for Lab Areas (Preventive Maintenance), and Handicapped/Safety. Appended resources for safety instruction, amounting to approximately one-half of the guide, include (1) general information sources regarding OSHA, (2) sample forms for reporting accidents/hazards, (3) sample safety inspection check list, (4) Connecticut Eye Safety Manual, (5) Color Coding for Marking Physical Hazards, and (6) Equipment Instruction Sheets and Evaluation (basic information followup quizzes). (YLB)

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INDUSTRIAL ARTS CURRICULUM GUIDE

FOR

SAFETY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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May, 1981

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Introduction

Effective safety education leads to attitudes and consciousness that result in safe work practices and prevent accidents within the industrial arts laboratory. In addition, effective safety education is one step in the right direction toward protecting the industrial arts instructor, supervisor, and school administrator against liability in the classroom and laboratory.

The task of overcoming the "it can't happen to me" attitude is a big one and requires that safety awareness be an integral part of the everyday instructional program. This guide is intended to serve in helping teachers develop and institute effective safety education as a part of all industrial arts instruction in the schools of Connecticut.

An effective safety program centers around several key considerations. These considerations are:

1. Provisions for safety instruction in all activities conducted in the industrial arts lab or classroom.

2. Supervision of students at all times in the industrial arts laboratory.

3. Documentation of safety instruction and student attendance at the time of instruction.

4. Assurance that all aspects of the industrial arts facility and its contents are safe for student activities.

This guide is intended to alert industrial arts teachers, teacher educators, school administrators, and industrial arts supervisors to the importance of a strong safety program. It is also intended to provide the instructional resources for instituting safety instruction in the public schools, for the inservice training of industrial arts teachers, and for the education of undergraduates in the teacher education programs of Connecticut.

How To Use This Guide

This guide has been placed in a loose leaf binder to make it flexible and useable for the industrial arts teacher. Recognizing the continuous developments in safety education and changing laws, the loose leaf binder permits additions and revisions without reprinting the entire document. All material contained in this guide may be reproduced by the teacher for use in safety instruction in the public schools. The teacher may also wish to add personal materials, lesson plans, safety instruction sheets and additional information to this binder to expand it into a complete safety program and lesson guide for the classroom.

The materials contained in this guide fails into several categories, which includes:

1. Safety Responsibilities
2. Safety Program Administration
3. Personal Safety Rules
4. Safety Practices in Industrial Arts
5. First Aid
6. Electrical Considerations
7. OSHA Machine Guarding Requirements
8. Specific Safety Considerations For Laboratory Areas
9. Safety Concerning the Handicapped
10. Resources For Safety Instruction

Special attention and explanation is needed for category eight, "Specific Safety Considerations For Laboratory Areas." Cognizant of the fact that the Power teacher will immediately search out his particular section and disregard the other areas; likewise the Wood, Plastics, Metals, etc., members of the safety committee felt it was necessary to be somewhat redundant in identifying general safety considerations for each of the shop areas. We sacrificed brevity for completeness.

The guide is not intended to be complete or all inclusive. It is intended to draw your attention to the necessity for safety instruction in every aspect of industrial arts and to provide you with the resources for upgrading and improving safety instruction in your classroom.

Policy Statement On Safety

A suggested safety education policy statement is provided below:

IT IS THE POLICY OF THE _____ SCHOOL BOARD THAT AN EFFECTIVE INDUSTRIAL ARTS SAFETY EDUCATION PROGRAM BE CONDUCTED THROUGHOUT THE SCHOOL SYSTEM, WITH ITS PRIME OBJECTIVE BEING ACCIDENT PREVENTION IN THE SCHOOL, AT WORK AND AT HOME. IN FURTHER SUPPORT OF THIS POLICY THE SCHOOL BOARD ADOPTS THE PROVISIONS OF THE CONNECTICUT INDUSTRIAL ARTS SAFETY GUIDE FOR INSTRUCTION AT ALL LEVELS.

The implementation of this policy will help make young people and adults more aware of the dangers that exist about them in today's industrial technological world and of the need for attitudes and habits that will ensure safe living and conservation of human resources.

The superintendent shall be responsible for implementation of this policy and shall make necessary appointments and delegate authority to see that effective safety training and procedures are carried out at all levels within the school district. The superintendent shall see that the safety laws, codes, administrative regulations and suggested practices of the State of Connecticut be followed and funded as they relate to the educational system. The staff should make extensive use of the appropriate safety guides, manuals and statutes that have been instituted and distributed by the Connecticut State Dept. of Education.

Connecticut Specific Guidelines For Industrial Arts

Grade Level

7 - 12 and Adult

Selection of Students

Open to all students who can profit from instruction, and work safely in a Lab/Shop situation

Length of Program

Level One (Exploratory) grades seven (7) and eight (8) - Lab/Shop classes meet a minimum of 60 hours per year. Lab/Shop periods must be of at least 40 continuous minutes and should not exceed 60 minutes.

Level Two (Occupational Orientation) grades nine (9) through twelve (12), or grades ten (10) through twelve (12) - students electing Level Two Industrial Arts courses must have the opportunity to participate in a minimum of 225 minutes of Lab/Shop activities per week, per semester. Daily Lab/Shop periods must be of at least 45 continuous minutes and should not exceed 60 minutes.

Level Three & Four (Specialization and Pre-Vocational) grades eleven (11) and twelve (12). Students that elect Level III & IV Industrial Arts courses must have a minimum of 450 minutes per week, per year of Lab/Shop activities. Daily Lab/Shop periods must be of at least 90 continuous minutes.

The definition of a year is a minimum of 180-day school days. A semester is 90 continuous school days.

Pre-Requisites

Successful completion of Level Two course prior to participating in Level Three. Successful completion of Level Three course prior to Level Four.

Enrollments

Based on Lab/Shop size and facilities, 16 students per class maximum in Lab/Shop areas and 20 students per class in drafting. The recommended and minimum square footages are as follows:

	Recommended		Minimum	
Jr. & Sr. High School	s.f./pupil station	Net total s.f. area	s.f./pupil station	Net total s.f. area
Drafting (including storage)	48 sf	1200 sf	40 sf	1000 sf
I.A. Jr. H.S. (including storage) Level One	100 sf	2500 sf	82 sf	2050 sf
I.A. Sr. H.S. (including storage) Levels Two, Three & Four	144 sf	3600 sf	120 sf	3000 sf

A classroom should be made available for related study, adjacent to the Shop/Lab areas. All facilities must comply with OSHA regulations.

Teachers Schedule

Industrial Arts contact hours for a full-time instructor should comprise

70% to 80% of their school week, and 20% to 30% of their time in industrial arts related non-teaching duties, such as maintenance and preparation of I.A. materials.

Equipment

All equipment must be in safe operating condition and conform to all federal, state, and local standards. Equipment must be:

A. Applicable to the level being taught, i.e., size, capacity, quantity, and necessity.

B. Enhance the program level and be similar to that found in industry.

C. Take into consideration: occupational education, consumer competency, leisure time activity, and environmental awareness.

Evaluation

Continuous evaluation by students, teachers, school, vocational, advisory committee, and state. Evaluation results must become an integral part of program development and improvement.

School Credit

Equal to other academic credit granted for similar periods of time and activities.

Youth Organizations

It is recommended that the American Industrial Arts Student Association (AIASA) be an integral part of the curriculum.

Teacher Certification

Instructors shall meet the minimum standards for Industrial Arts teachers provisional certification as outlined in the "Rules and Regulations Concerning State Teacher Certification" section 10-146-21 and section 10-146-22.

Standard certification requires three (3) years of teaching under a provisional certificate, the last two (2) years consecutive and a master's degree or thirty (30) semester hours, consisting of a planned program at an approved institution of higher learning and an individual program, mutually determined and approved by teacher and supervising agent.

Teachers of Industrial Arts to be funded through the Vocational Education Acts must comply with section 10-146-22 above, have one (1) year of appropriate occupational experience and complete Principles of Vocational Education, a three (3) semester hour Vocational-Technical Education course.

Sex Stereotyping

Existing activities and future plans must show evidence of actions directed toward the elimination of sex stereotyping, including continual effort to attract females to elective industrial arts courses traditionally chosen by males. Industrial arts courses which are required for any students at a particular level must be required of all students, male and female.

I. Safety Responsibilities

A. Administrators

1. Keep abreast of state and federal safety legislation and regulations
2. Become thoroughly familiar with your industrial education department's safety program
3. Become thoroughly familiar with the State's recommended student per square foot assignment for each of the labs
4. Establish ceiling numbers of students for each lab taking the State's recommendation into consideration
5. Do not assign more students to a given lab once the safe ceiling numbers have been established
6. Provide adequate financial support for new and/or replacement safety equipment
7. Cooperate fully with those in the organization who are actively concerned with employee and student safety
8. Cooperate in investigation and analysis of every accident
9. Set aside time during school-wide staff meetings to discuss the industrial safety program
10. Investigate town resources for safety protection (E.M.S., C.P.R., etc.)

B. Supervisors - Department Chairperson

1. The overall responsibility to develop, implement and administer the program of accident prevention in the department
2. Keep abreast of, and adhere to state and federal legislation and regulations
3. Make sure all of the instructors are trained in their safety responsibilities and that they carry them out effectively
4. Safety discussions and demonstrations should be regularly planned for department meetings

5. Together with the teacher, immediately investigate all accidents and near accidents

6. Establish a procedure for reporting accidents, and analyze accidents for cause and effect

7. Conduct regular safety inspections of all the labs under their control

8. Reward instructors who closely adhere to the safety program

9. Recommend and secure all necessary safety equipment, etc.

10. Has the responsibility for instructing new teachers in the operation of the town safety program

11. The department head should see that the instructors apply approved preventive and corrective disciplinary measures

12. Help determine class size with Principal

13. Determine town resources for safety programs (E.M.S., C.P.R., etc.)

C. Instructors

1. Develop a positive attitude toward personal and student safety

2. Wear safety glasses and require all visitors and students to wear safety glasses at all times while in the lab

3. Keep abreast of, and adhere to state and federal legislation and regulations

4. Completely implement the accident prevention safety program

5. Trains the students to carry out effectively the program of accident prevention

6. Report unsafe working conditions to the Department Chairperson

7. Be present at all times and maintain a direct line of sight to all students and their acitivities

8. Conduct personal inspections of the operations under their supervision, with special emphasis on good housekeeping

9. Call the student's attention to hazards in the laboratory and instruct students in the proper care and use of materials and equipment

10. Maintain the tools, equipment and machinery in proper running order

11. Know what to do in case of accidents, fire, etc.

12. Report all accidents, no matter how small, to the Department Chairperson

13. Aid the Department Chairperson in accident investigations

14. Keep strict discipline and control during class

15. Be safety conscious and set a good example

16. Help determine class size

D. Students

1. Wear safety glasses and protective equipment at all times

2. Wear proper clothing

3. Roll up sleeves and remove jewelry while working in the lab

4. Report all accidents to the instructor immediately

5. Restrain long flowing hair - (Hair that reaches eyebrows and below ear lobes)

6. Stop all machines before measurements or adjustments are made

7. Place machine guards in their proper position before machines are put into operation

8. Operate machines only after being authorized to do so, or under the supervision of the instructor

9. Check with the instructor on all set-ups for new operations before starting the machine

10. Never leave a machine running unattended

11. Keep your fingers away from moving parts or machinery
12. Do not use hands to stop a machine or moving parts
13. Never lift heavy objects without help
14. Do not distract machine operators
15. No horseplay in the lab
16. Do not throw objects of any size in the lab
17. Keep floor areas clear
18. Report tool damage to the instructor
19. Know the location and use of protective fire equipment
20. Know the location of emergency power switches

II. Safety Program Administration

Administration of a safety program has one key element, the development of a system to locate, evaluate and control those potential safety hazards which occur in the Industrial Education Lab.

The team approach of Safety Committee is the only effective tool for involving all members of the instructional program in accident prevention and safety instruction.

Direction and policy must be set by the Industrial Education Administrator. Principals and Vice Principals provide needed support and program assistance. The instructor, however, plays the key role becuase of his/her daily contact with the student. A safety program only goes as far as the enthusiasm and interest of the classroom instructor. Students themselves must also play an active role in the program because of their position as the focal point for accident protection. Final positions on the committee should be occupied by those persons responsible for purchasing and maintaining equipment.

It is hoped that the attached outline will help you to develop your Safety Program Administration with emphasis on accident prevention rather than investigation.

The committee is made up of school administrators, staff and students. Major roles are to assist in development of objectives, policy, perform monitoring functions, educational investigative and evaluative tasks. Advising in safety areas will be related to shop operations. Recommendations must specify what is to be done, when and by whom.

A. Objectives — that must be considered should include but not be limited to the following:

1. Gaining and maintaining support for the Safety Program.

2. Development of activities to motivate, educate and train all those involved in the Safety Program.

3. Develop programs to assist in the training of people to recognize, correct and report hazards in the lab.

4. Make recommendations for guards, machine controls and other safety devices.

5. Develop safety inspection programs.

6. Assist staff in development of instructional techniques to insure student recognition of safety hazards.

7. Assist in safety compliance programs.

B. Policy

Finalization of objectives will allow Administration to develop policy. Policy statements must include the following:

1. Statement of purpose for the Safety Program.

2. Requirements for those involved in the program.

3. Statement on importance of safety to staff and students.

4. Emphasis on efficient operation with a minimum of losses and accidents.

5. Emphasis on hazard control related to safe shop operations.

6. Require active leadership, participation and support from the entire school organization.

7. Statement of school authorities to bring all equipment and processes into safety compliance.

8. Committment to adequate funding.

C. Committees Role in Program Implementation

Following are the specific roles a Safety Committee may participate in:

1. Periodic shop and facility inspection. Emphasis is on Hazard Detection, Environmental Problems, Unsafe Procedures and Practices.

2. Evaluation of accident and injury data.

3. Accident investigation.

4. Safety training.

5. Hazard analysis.

6. Review and upgrading of safety instruction techniques.

7. Recommendations for safety equipment.

8. Development of Program Regulations.

9. Promotion of Safety Training.

D. Committee Effectiveness

To insure effectiveness the following guidelines must be maintained.

1. Regular meeting must be scheduled and held. Formal rules of order followed.

2. Committee members must be sincerely interested in Safety Program Development.

3. Recommendations by the group must be considered and accepted if valid.

4. The committees work must be publicly recognized.

5. Members must be provided with agendas and meeting summaries.

E. Lab Inspection

A lab or shop inspection is a survey conducted in the work area to locate and report existing and potential hazards which may cause accidents.

Emphasis must be on fact-finding not on criticism. The inspections must locate and reduce potential hazards. Fault finding will not improve safety, it will only produce negative attitudes toward safety programming.

Inspections should be made by all those involved in the lab. Frequency of inspection will depend on the persons role. Teacher and student may conduct daily inspections. Administrators may be involved in periodic inspections.

Continuous inspection involves hazardous conditions or unsafe acts which can be corrected immediately, or have corrective action initiated. Teachers daily inspections would meet this criteria. Periodic inspections are deliberate and thorough in nature. Emphasis is on all lab areas.

1. Lab Inspection Form

Some device must be developed to record inspection finding and to assist those who must deal with the implementation of the report. A thorough safety inspection form should record findings in the following areas:

a. Materials and Substances

b. Machinery, Equipment, Tools, etc.

c. Personal Protective and Safety Equipment

d. Working Surfaces

e. Walking Surfaces

f. Environmental Factors

g. Housekeeping

h. Medical Services

i. Electrical Equipment

j. Chemicals

k. Fire Protection

l. Maintenance

F. Follow-Up on Lab Inspections

The most important facet of a lab inspection program is; "What is done with the data collected". Problems and recommendations must be brought to the attention of proper parties for corrective action. Recommendations would usually include the following:

1. Change a procedure. Set up a safer method for completing the instructional task.

2. Reduce exposure. Change the location of the operation or equipment so that students or teachers will not have general exposure to a hazard.

3. Redesign a tool, machine or fixture valued in hazardous activities.

4. Increase training to personnel involved in hazardous activities.

5. Provide personal protective equipment.

In deciding what must be done about a particular problem cost-effectiveness plays an important role. However, reduction of accidents, improvement of conditions and improved morale play an important part in effective safe instruction.

III. Personal Safety Practices

These safety guide lines have been prepared for the benefit of you and your students. But naturally they can only be beneficial if they are read, understood, put into practice, and become a matter of habit.

In trying to enumerate a list of personal safety practices that could be applied to all areas of Industrial Arts Education, we realize they will be repeated throughout this guide under other specific sections perhaps using different terminology, but aimed at achieving the same desired outcome; the prevention of accidents.

A. Personal Practices

1. The proper use of tools, machines, and materials is necessary for shop safety.
2. Students must develop good safety habits. These are for your protection and the protection of others.
3. Each student is responsible for assisting in shop cleanup.
4. When in doubt, ask your teacher. Do not depend upon the advice of another student.
5. Caution other students if you see a violation of a safety practice.
6. When using machines or hand tools, give the job at hand all of your attention.
7. Every injury, no matter how slight, must be reported immediately to your teacher.
8. Loose clothing, jewelry and gloves are not to be worn while you are working with power tools.
9. The motion involved in striking or cutting must be done away from oneself and other students.
10. Safety Glasses must be worn at all times.
11. Sharp, pointed tools or materials are not to be carried in clothing. Cover sharp edges. Hold sharp points down.

12. Disturbing another student while he is working is a dangerous practice.

13. A student who sees a dangerous situation must report it at once to the teacher.

14. Report to the teacher all breakage or damage to tools, machinery or equipment.

15. Lifting heavy objects may result in injury. Lift properly, or get help if necessary.

16. Completely dry hands before touching electrical switches, plugs or receptacles.

17. "Horseplay", running, and the throwing of objects are dangerous practices in any shop and are forbidden at all times.

18. Nails, tacks and other nondigestible materials are never to be placed in one's mouth.

B. Shop Practices

1. Students are to operate only those machines for which they have received instruction and permission to operate.

2. Guards and other safety devices are for the protection of the operator and must always be in place.

3. The main power switch in the shop must be turned "on" or "off" by the teacher.

4. All special setups must be checked by the teacher before power is turned on.

5. Do not lean on machines. Stand clear.

6. Observe safety lanes. Only the operator and teacher are permitted within the working area around a machine.

7. Repairs are to be made on shop equipment only when permission has been given. Do not tamper with shop equipment.

8. If equipment is not working properly, shut it off and tell the teacher at once.

9. Gasoline, kerosene, paints, lacquer thinners, chemicals, and other finishing or cleaning materials are to be used in a well-ventilated room. They are never used near an open flame.

10. Oil or grease on floors is slippery and dangerous. Clean it up at once.

11. Cloths and rags filled with flammable materials are to be placed in a covered metal container (red).

12. Keep floors, aisles, and passageways clear of stock, tools, and materials.

C. Fire Prevention

Fires rarely occur naturally. As a rule, personal carelessness cause fires. Unfortunately, innocent people suffer injury or death along with the careless individual. By practicing these fire prevention rules, you can help prevent injury to yourself and others.

1. Learn the locations of fire extinguishers.

2. Become familiar with the operation of all types of extinguishers located in the shop.

3. Nothing shall be hung on fire extinguishers, and the area around them must be kept clear so that they may be reached without delay if fire breaks out.

4. Oily or paint-filled rags must be placed in a covered metal container (red). Oily and greasy shop clothing must be stored in lockers. Never roll it up.

5. Gasoline, kerosene, paints, thinners, and other finishing materials shall never be stored or used near an open flame.

6. Lighting of matches or cigarette lighters has no place in the shop.

7. When pouring flammable liquids, be careful not to spill them.

8. There are 4 classes of fire. The methods of extinguishing these fires are as follows:

   a. <u>Fires involving combustible material, wood, paper, or cloth</u>

To extinguish cool and quench with pump-type or soda and acid extinguishers. CO_2 (carbon dioxide) extingushers may be used.

b. Fires involving flammable liquids such as gasoline, kerosene, greases, thinners, and paints

Smother the burning fuel. Foam and CO_2 type extinguishers may be used.

c. Fires involving electrical equipment

Use a nonconducting-type extinguisher such as CO_2 or dry powder.

d. Fires involving combustible metal

9. In case of fire in the shop

a. Sound the alarm

b. When personal safety is endangered, leave the building

c. Follow your school policies

IV. Safety Practices In Industrial Arts

A. Eye Safety

Protective eye and face equipment shall be required where there is a reasonable probability of injury that can be prevented by such equipment. (Reference to state eye guidelines)

No unprotected person shall knowingly be subjected to a hazardous environmental condition. Suitable eye protectors shall be provided where machines or operations present the hazard of flying objects, glare, liquids, injurious radiation or a combination of these hazards. (See Appendix of forms and regulations)

B. Safety Color Code For Marking Physical Hazards

1. Introduction

Color schemes for the identification and location of fire extinguishers, first aid kits, traffic aisleways, stumbling and tripping hazards, radiation, etc., have been developed in the past by a large number of industrial plants, paint manufacturers, and other organizations.

Generally speaking, these standards arrived at in individual cases have given satisfaction to those using them. They suffer, however, from lack of uniformity. It is intended that use of this code should supplement the proper guarding or elimination of hazardous conditions. The marking of a physical hazard by a standard color warning should never be accepted as a substitute for the complete elimination of the hazard wherever this is possible.

It is also recognized that too many color identifications constantly in the field of vision of the students are both confusing and fatiguing. Each location should therefore be carefully studied in order to keep the number of markings at a minimum, thereby providing even greater emphasis for the markings which are used.

2. Scope

This safety color code defines the application of colors to specific purposes in connection with accident prevention and recommends the colors

to be used for such purposes as the marking of physical hazards, the location of safety equipment, and the identification of fire and other protective equipment, etc.

3. Color Identification

RED - Red shall be the basic color for the identification of:

1. Fire protection equipment

2. Danger

3. Stop

A partial list of suggestions for the application of the color red is as follows:

Fire exit signs
Fire alarm boxes
Fire blanket boxes
Fire extinguishers
Sprinkler piping
Safety cans
Danger signs
Emergency stop bars or buttons

ORANGE - Orange shall be used as the basic color for designating dangerous parts of machines which may cut, crush, shock, or otherwise injure and to emphasize such hazards when enclosure doors are open or when gear, belt or other guards around moving equipment are open or removed, exposing unguarded hazards.

The following is a partial list of suggestions for the application of the orange:

Inside of movable guards
Safety starting buttons
Inside of guards for gears, pulleys chains, etc.
Exposed parts (edges only) of pulleys, gears, rollers cutting devices, power jaws, etc.

YELLOW - Yellow shall be the basic color for designating caution and for marking physical hazards such as striking against, stumbling, falling,

tripping, and caught in between. Solid yellow, yellow and black stripes, yellow and black checkers should be used interchangeably, using the combination which will create the best attention in the particular environment.

The following is a partial list of suggestions for the application of the color yellow:

Corner markings for storage piles
Exposed and unguarded edges of platforms and walls
Handrails, guardrails, and top and bottom treads of stairways
Lower pulley blocks
Pillars, posts and columns
Caution signs
Warnings against starting or use of machinery under repair

GREEN - Green shall be used as the basic color for designating SAFETY and the location of first aid equipment.

The following is a partial list of suggestions for the application of the color green to show the location of:

Safety bulletin boards
First aid kits
Stretchers
Safety showers

PURPLE - Purple shall be the basic color for designating radiation hazards. Yellow should be used in combination with purple for markers such as tags, labels, signs and floor markers.

BLACK, WHITE, OR COMBINATIONS OF BLACK AND WHITE - Black, white, or a combination of these two shall be the basic colors for the designation of traffic and housekeeping markings. Solid white, solid black, single color striping, alternate stripes of black and white, or black and white checkers should be used in accordance with local conditions.

C. Signs

The wording on any sign should be easily read and concise. The sign should contain sufficient information to be easily understood. The wording should make a positive, rather than negative suggestion and should be accurate in fact.

D. Fire Safety and Prevention Guide for Industrial Art Shops, Stage Craft, Vocational Agriculture and Arts & Crafts

The following is a recommended guide for use by instructors in Industrial Art Shops, Stage Craft, Vocational Agriculture, Arts & Crafts and related instructional areas.

The interpretation of the reference material used in this guide may vary with the local fire marshall in jurisdiction. Questions regarding this guide should be directed to the State Fire Marshall's Office, of the Public Safety Division of the State Police, or the State Department of Education, Bureau of School Buildings.

Consultation with the related consultant, within the State Department of Education or State Occupational Safety and Health Department regarding safe procedures and equipment locations, and with the local fire marshall in jurisdiction for local requirements is recommended.

The responsibility for the school plant and its inhabitants is a local one. Section 10-220, Duties of Boards of Education states in part: "...shall have the care, maintenance and operation of buildings, lands, apparatus and other property used for school purposes...", Section 29-43 of the General Statutes states "...any person who violates any provision of the fire safety code shall be fined not more than $200 or imprisoned not more than 3 months or both". Therefore, all school personnel are obligated to establish and maintain fire safety and prevention within their area of responsibility.

1. General Classrooms

   a. Keep heating and ventilation units clear of stacked papers, books and drying cloths.

   b. Do not allow students' coats to be stacked on desks or equipment near exit doors, where they may impede exiting during panic.

   c. All furniture and equipment shall be located so there will be adequate exit aisles, and doorways are never blocked in classrooms.

   d. Shut off all gas and electrical appliances at end of day or evening classes, and have emergency gas shut-off valve and key easily accessible at all times, such as on demonstration table or adjacent wall.

e. Use only a reasonable amount of flammable decorations in classrooms and in no case should an entire wall in a school be covered with combustible materials, nor should they be used adjacent to an exit.

f. Be informed of the emergency evacuation plan and see to it that all day and night students understand it well.

g. Do not overload or over-fuse electrical circuits. Use only UL approved extension cords and appliances.

2. Industrial Art Shops, Stage Craft, Vocational Agriculture, Arts & Crafts and related areas

a. Industrial Art shops, Stage Craft and Vocational Agriculture shops shall have two separate means of egress, as remote as possible from one another, one to an interior corridor and one directly outside of building or through adjoining room and outside of building.

b. Arts and Crafts rooms shall have two separate and remote means of egress. One to an interior corridor and one through an adjoining room and thence to a corridor and out.[1]

c. Fire detectors are required for complete coverage of all work areas, finishing rooms and areas, storage rooms and related garages, unless such areas are completely covered by sprinklers.

d. All areas shall be kept reasonably clean and all waste kept in metal containers with metal covers. All waste material shall be removed from respective areas at the end of the class day and properly disposed of. Waste material should not be left in such areas overnight.

e. Dust collecting units shall be properly maintained, be equipped with devices to prevent a flash back at points of intake if waste material is ignited, and should be located on exterior walls and vented directly outside.

f. An emergency master gas shut-off valve shall be located in any room or area where there are multiple gas service outlets. This valve and key should be easily accessible to the instructor, at all times.[2]

g. Flammable liquids shall be stored in proper metal or wood storage cabinets, that are well vented as directly outside as

possible, and are properly labeled as to hazard of contents. (Ref.: Regulations Governing the Storage, Use and Transportation of Flammable Liquids of Conn. State Police and National Fire Protection Assoc. Regulations)

h. Flammable liquids shall be stored in and dispensed from approved containers only and shall be returned to storage area as soon as possible after use.

i. Fire extinguishers, for the proper type of coverage needed in an area shall be readily accessible to the instructor.

j. Gas and oxygen cylinders for welding shall be stored at least 20 feet from highly combustible materials, where they will not be exposed to excessive rise in physical temperature or tampering by unauthorized persons, with caps on all cylinders not being used. A key should be attached to every cylinder by a chain.

k. All electrical power for equipment used by students, should be controlled by emergency master shut-off switches located in at least three remote locations. They should be capable of shutting off all power in the whole shop. The main electrical power panel controlling all power in a shop, should be locked at all times, so unauthorized persons cannot operate power equipment without the instructors knowledge.

l. Finishing rooms or areas shall be segregated from other areas by noncombustible construction, with wire glass in all interior windows, have explosion proof electrical fixtures and equipment, outward swinging self-closing doors with outdoor hold open devices, be located on exterior walls if possible, be well vented directly to the outside and be used for no other purpose.

m. Finishing or spray booths enclosed or partially enclosed are small concentrated hazardous units and shall be well vented as directly outside as possible, have explosion proof electrical fixtures and equipment, be properly cleaned and maintained and should not be located adjacent to required exits.

n. Portable butane gas tanks should not exceed 1 pound capacity and such butane tanks or aerosol spray cans shall be stored as flammable liquids in locked metal cabinets marked "Danger Keep Fire Away".

o. Welding or forging areas should not be directly adjacent to combustible material. Spark arresters should be located around welding cubicals or areas. Such areas shall be properly maintained to prevent the ignition of any adjacent combustible material.

3. Fire Safety and Fire Prevention

1. Shop projects or related projects

a. Students should be made aware of any possible hazard prior to the start of any project involving the use of hazardous machinery or equipment, the use of dangerous chemicals, compounds or liquids and what they should do if an emergency arises.

b. Students should know the proper use of all equipment, machines, dangerous chemicals, compounds or liquids prior to using such items.

c. Students should not be permitted to indulge in "horseplay" during any shop work or project.

d. Instructors should know how to handle any possible emergency that may transpire in his area of instruction, and have the necessary items readily available to handle such an emergency involving student participation.

2. Storage

a. Flammable Liquid

1. Quantities of flammable liquids in excess of fifty gallons total shall be stored in a two-hour fire rated room with a self-closing class "b" type door, vented directly to the outside, preferably on an exterior wall and have a fire detector.

2. Quantities of flammable liquids in excess of a days supply shall be stored in proper metal cabinets marked "Flammable-Keep Fire Away" - in no more than five gallon containers and not exceeding fifty gallons per cabinet.

3. Flammable liquids shall not be stored in boiler rooms, mechanical rooms, incinerator rooms, or any area considered hazardous by fire marshall.

4. Quantity of flammable liquids is limited by regulation in any room to the amount immediately needed for a particular project or machine only, and only in metal safety containers or other approved containers. No container shall exceed a capacity of one gallon, except that safety containers can be of two gallon capacity.

5. After using flammable liquids they shall be returned to proper metal or wood storage cabinets immediately.

b. Properly label all storage cabinets as to hazard of contents.

c. Have emergency instructions conspicuously posted near all storage areas on proper procedures in case of fire, explosion, chemical reaction or spillage.

d. Hazardous equipment and storage cabinets or rooms for dangerous chemicals, gases, compounds or liquids shall not be located adjacent to exits.

e. Paint brushes or spray units should not be allowed to soak in open containers. Such items should be cleaned after use and properly stored immediately.

f. Combustible materials shall be stored in a neat manner in their designated areas.

g. No internal combustion powered vehicle, car, truck, tractor, lawn mower, etc., is permitted to be stored in an industrial arts or vocational agriculture shop unless, it is being repaired in such shop. All such equipment not being repaired shall be stored in a separate garage with no access to any other area permitted from within such garage.

3. Fire, Explosion and Spillage Emergency

a. Instructor should have knowledge of how to handle any possible emergency that could transpire in instructional area.

b. Depending upon individual emergency situations the instructor should:

1. Know Fire Safety procedures of school;

2. Be capable of deciding immediately whether to sound fire alarm, evacuate room or use emergency fire first aid;

3. Have knowledge of first aid for chemical burns or injuries and how to react in such emergencies;

4. Know the possible reactions of dangerous chemicals and compounds, or gases during an emergency.

E. Laboratory Housekeeping

Laboratory housekeeping plays an extremely important role in creating a conducive learning environment for students. It not only enables students to be more productive with their limited time, but it improves the quality of the work produced. Most important of all, a properly maintained industrial education laboratory provides for a safe, relatively hazard free learning situation. The following are some of the laboratory housekeeping activities all shops and instructors should strive for:

1. A consistant student clean-up procedure should be established and carried through to its full potential.

2. Every tool should have a specific place with a pre/post tool check to guard against lost tools.

3. Machines should be kept cleaned and properly painted.

4. Preventive maintenance should be a regular part of the program, with machine lubrication as scheduled by the manufacturer.

5. Specialty tools should be organized, labeled and made available in the immediate area they are needed (ex. welding and casting aprons, gloves, leggings, etc.).

6. Always keep tools sharp and in proper operating condition.

7. Entrance and exit aisles should be kept clear at all times.

8. Aisles should be clearly arranged and marked.

9. Floors should be kept clear of rubbish, materials, etc.

10. Floors should be kept dry at all times.

11. Slippery floors should be rendered non-slip by painting them with an abrasive substance.

12. Lifts and areas around lifts should be periodically washed.

13. Student materials should be placed in suitable racks so as to provide easy access and be non-obstructing to classroom activities.

14. Material storage areas should be clear and well organized.

15. Student project storage areas should be organized and secured against loss.

16. Sand and finish wood top benches at least once a year.

17. Keep lockers, machines and other appropriate surfaces painted and maintained.

18. Work surfaces should be clear of extraneous materials.

19. Prior to leaving for the summer vacation, lubricate all metal surfaces with an antirust substance.

20. Safety glasses cabinet should be kept clean and organized.

21. Safety posters and subject related information should be displayed and changed frequently.

22. Before using electrical portable tools, check them for a broken plug, bad connection, broken switch or poor insulation on the cord.

23. Make sure all electrical tools are grounded.

24. When using a ladder, make sure the correct 75 degree angle is maintained.

25. Make sure the proper fire extinguisher is filled and available.

26. Flammable liquids should be stored in safety metal cabinets vented to the outside.

27. Oily rags should be stored in metal safety cans and emptied daily.

28. Handout materials should be organized in file cabinets.

29. Keep safety shields, etc. in good working order.

30. Remove obsolete tools and machines from the shop area.

31. Safety inspections should be regularly conducted.

F. Environmental Considerations

General

Industrial Arts shops should be designed to take into account a proper atmosphere for the area in question. Each industrial area has certain characteristics that influence the design of the room and the location of the equipment.

Environmental considerations should be taken into account also.

The air in a room should be circulated. Clean and replenished, i.e., fresh air should be introduced continually.

Many processes cause air polution in that small particles of the material get into the air, and if not removed, tend to remain. If they are not removed, they are breathed in by people in the room.

Some industrial processes create noise that is louder than a person should be subjected to for various periods of time. Arrangements should be made to reduce the noise made by the equipment, to isolate the equipment, protect the ears of those working in the area, or some combinations of the above, so one's ears are not hurt.

There are industrial processes that involve the use of materials that are toxic. Arrangements must be made to withdraw the fumes of such substances to the extent possible, and to otherwise protect the staff and students where and when they might come in contact with such substances.

1. Air

Where appropriate, dust and smoke collection equipment should be used in shops. Such equipment should probably be piped directly to the equipment in question, to remove as much of the substance in question as possible.

In some situations, such equipment is not adequate, in the sense that it removes only the particles that are heavier than air.

The remaining particles should be removed with electrostatic collectors.

2. Noise

Noise levels of machinery and equipment must be controlled as much as possible.

If the noise levels cannot be reduced to appropriate levels, personal sound protection equipment should be provided for those working in the area.

Recommended duration of exposure to sound levels, per day follows:

DURATION PER DAY, HOURS	dB
8	90
6	92
4	95
3	97
2	100
1 & 1/2	102
1	105
30 min.	110
15 min.	115

Exposure to implosive or impact noise should not exceed 140 dB peak sound pressure level.[3]

3. Toxic Substances

Permissable exposure to toxic substances varies with the substance.

Compliance with regulations concerning such exposure should be achieved to the greatest extent possible.

If engineering and administrative controls cannot totally solve the problem, protective equipment or protective measures must be used. Equipment and technical measures required must be approved by an industrial hygienist.

If respirators are used, they must conform to the appropriate regulation.

Contaminents are listed in Connecticut Safety and Health Handbook under section 1910.93, on pages 23540, 23541, 23542, 23543.

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1 School buildings existing on December 15, 1953 do not have to comply with this particular regulation unless they have been altered by construction in this particular area since December 15, 1953.

2 School classrooms using gas prior to 1959 and not having been altered by construction since 1959 should comply with this recommendation unless specifically required by the fire marshall in jurisdiction or a local regulation.

3 Connecticut Safety and Health Handbook, Volume 1 - General Industry Standards. #1910.95 Occupational Noise Exposure, pages 23596 and 23597.

V. First Aid

First aid means the immediate, temporary care given to the victim of an accident, until the services of a professional can be obtained. In an emergency, a teacher not only has the legal right to administer first aid, but would in all probability be considered derelict in his or her duty if they did not attempt to act for the benefit of their pupils. However, teachers should remember the key to first aid practices is never to go beyond their area of their expertise. Do what you are competent to do and what is necessary, then call in your school expert; the school nurse. Do not attempt treatment beyond first aid under any circumstances.

Remember, this section on first aid is a guideline for you to follow in case of emergencies. In no way should it be construed as a curriculum in first aid.

First Aid, like any other safety practice, should follow a regular procedure. The procedure will vary according to the type of accident, but the instructor should always follow a regular procedure for the reporting and handling of each accident that takes place in the school and shop.

Primary considerations are those things which must be done immediately following an injury.

Secondary considerations are things which should be done after the confusion has lessened. This does not mean that the secondary considerations should be postponed, but that the necessities should be taken care of first.

A. Primary Procedure

Primary considerations would relate directly to the care and welfare of the injured pupil. This is paramount. The degree of care necessary would be determined by the seriousness of the injury. Certain basic steps are recommended in caring for an injured pupil. These are as follows:

1. Attempt to ascertain how serious the pupil is injured. If in any doubt, get assistance.
2. If medical assistance is needed, send for it immediately.
3. Apply only the first aid which is essential and nothing further.
4. Notify immediate supervisor or principal.
5. If pupil has a minor injury but needs the assistance of the school nurse, send the pupil to nurse's office accompanied by another pupil. Never send an injured pupil alone.

6. Report all injuries to school nurse, both major and minor.

Individual school systems will have established procedures which may vary from these listed. They will normally conform to specific state and local regulations governing the care of injured pupils. It is imperative that teachers be aware of these regulations and follow them to the letter.

B. Secondary Considerations

After the immediate needs of the injured pupil are cared for, the teacher has additional responsibilities which stem from an accident. Recommended steps of procedure would include the following:

1. Stabilize and re-assure the other members of the class.

2. Fill out an accident report in triplicate, complete the statement from witnesses (one copy for school nurse, one for principal or immediate supervisor, and one for your own file).

3. Analyze accident in view of known facts.

4. Ascertain the cause of accident.

5. Set out to eliminate the possibility of a similar accident occurring again.

6. Review safety practices and procedures.

7. Check on progress of injured pupil.

Specific first aid practices to follow in cases of injury in school and shop.

Always remember in all of these practices to only do what is necessary. Never exceed your level of competency. Let your expert in the program do their job. This, in most cases, being your school nurse.

What is First Aid? It is just that - the first aid, the first help, or immediate care and temporary help given to someone who has been hurt or suddenly taken sick.

C. Stopped Breathing

Use CPR (Cardio-Pulmonary Resuscitation). If you don't know how to do this properly, don't attempt it. Remember, you have 10 minutes to save someone's life who has stopped breathing, so get help in a hurry. Start rescue breathing while someone goes for help. Maintaining an airway may be all that is necessary until help arrives.

D. Bleeding

Stop bleeding by using direct pressure; elevate limbs if necessary while maintaining pressure. Never use a tourniquet. Send for help. Treat for shock. Keep feet higher than head, provided there are no broken limbs. Place blanket under body if possible, and cover with blanket for warmth.

E. Internal Poisoning

Get the school nurse immediately. Poisons need to be teated in different manners. The nurse is the school expert. Do not induce vomiting if petroleum, chemicals or lye base materials have been swallowed. Save all vomiting and suspected material in a container.

F. Burns

Apply cold water or a cold water soaked towel to burn immediately. Never use cream or ointments on 3rd degree burns. Treat for shock and send for nurse.

G. Bruises

Apply cold cloths or ice packs to relieve pain and reduce swelling.

H. Coma or Unconsciousness

Call nurse. Maintain body heat and airway.

I. Convulsions/Seizures

Call nurse. DO NOT RESTRAIN VICTIM. Remove any surrounding objects which may cause further injury. If possible, place a SOFT item (ex. wallet, corner of pocket book, wad of cloth or tongue depressor wrapped heavily with tape) between the teeth of victim to prevent biting of the tongue.

J. Electric Shock

Remove person from contact with current using a non-conductor such as dry wood. Do not endanger your own life. Give artificial respiration or CPR (Cardio-Pulmonary Resuscitation) if qualified and if needed until the nurse arrives. Keep victim warm. Call for immediate assistance.

K. Fainting

Place in prone position with head lower than body. Loosen clothing. Call nurse.

L. Fractures & Dislocations

Send for nurse. Keep patient still. If legs, back or neck are injured, lay flat. Cover wounds with available clean fabric. Do not attempt to reinsert any protruding bones.

M. Gas Poisoning

Shut off gas or motors. Remove victim to open air. Apply artificial respiration if necessary. Keep victim warm.

N. Nose Bleed

Apply cold cloths or "quick ice", and press firmly on outside at bridge of nose. Hold head back.

O. Swallowing Foreign Objects

Handle gently and calmly. Lean patient over a chair so that head is below lungs. Slap victim 4 times (slaps should be hard and forceful) between the shoulder blades. NEVER reach into a patient's mouth in an attempt to remove food. If in 3 minutes patient does not recover and breathing has stopped, attempt artificial respiration by forcefully blowing into lungs. Call for assistance immediately.

P. Eye First Aid

For liquid in the eyes, flush immediately (acids at least 5 mins., alkalies 20 mins.), then send for nurse immediately. For solid material in the eye, cover both eyes loosely with gauze compress. Never remove a lodged object from the eye. Loosely cover eyes, stabilize protruding object. Again, send for nurse immediately.

Q. Impaled Object

Never attempt to remove an impaled object from the body. Immobilize the protruding object by packing around it to prevent movement of object. Get help immediately. If the object is fixed, do not remove the body from the object. The object must be disconnected from it's permanent position.

R. Back Injuries

Do not move. Check for spinal cord injury by asking victim to press their hand against yours, then ask them to move their feet by tilting them back and forth. Get nurse and let her handle the situation from this point.

S. Open Wound with Evisceration

Do not attempt to replace the protruding organ. Cover the wound and protruding organ with a piece of non-adhering material, such as plastic wrap or aluminum foil. Cover with a dressing (sheet or towel if no other material available). The cover serves to retain warmth in the protruding organ. Get help immediately.

T. Sucking Chest Wound

Cover hole with hand if no other materials are available. This will prevent lung collapse. Get help immediately.

U. Evacuation

In case of fire or explosion where injured students are in building, use fireman's carry, chair carry, or drag victims from scene to safe territory.

V. Emotional Disorders

Handling a disturbed or violent student may be difficult. There are no set rules that can be applied to every situation, but the following suggestions may prove helpful in managing the majority of aggressive patients.

1. Don't be in a hurry.

2. Evaluate the situation.

3. Keep your own emotions under control.

4. Be honest.

5. Avoid force.

6. Isolate the situation by removing other students.

W. Summary

The specific first aid practices mentioned cover most emergency cases that could occur in any school or shop program. The individual instructor should be aware of what to do in case of being confronted with one of these situations.

As a teacher, you assumed the responsibility for the welfare of the students in your charge when you accepted your job. Therefore, you should be prepared to act in case of an emergency.

Make it your business to know if you have any students in your class with medical problems that could be hazardous for them to work on certain machinery or with some materials.

It can't be said too many times that you don't overstep your bounds with first aid. Only do what is necessary and get help immediately from your school expert.

ACCIDENT REPORTING

Any accident that occurs during industrial arts activities and in the industrial arts shop must be reported. This applies to after school accidents as well as those during the school day. Any accident, even a slight cut, must be reported since this indicates corrective action that must be taken by the teacher, administrator, or both.

A form for the reporting of these accidents can be adapted from the one on the following page. This report should be completed in triplicate; one for the principal, one for the school nurse, and one for the teacher's permanent file.

ACCIDENT REPORTING AND ANALYSIS

1. Require students to report all accidents to the teacher, regardless of nature or severity.

2. Keep a record of all industrial arts accidents resulting in injury to students, regardless of nature or severity.

3. Analyze all accident reports for the purpose of aiding in the prevention of other accidents.

4. Use your school district's printed or duplicated form to record the details of accidents and forward to the appropriate personnel.

INDUSTRIAL ARTS DEPARTMENT

Student Accident Report

TO BE COMPLETED BY INSTRUCTOR

Student Name _____ Grade _____

Location of Accident _____ Time _____ A.M.___/___P.M.
(Lab Area)

Date of Accident _____

Description of Injury _____

_____

_____

Location of Instructor when Accident Occurred: _____

Description of How Accident Happened: _____

_____

_____

Indicate Equipment, Machinery, or Tools Involved: _____

Describe unsafe practices, if any, contributing to accident: _____

_____

_____

Suggestions for prevention of similar accident: _____

_____

Witnesses to Accident: 1. _____

2. _____

Instructor's Signature _____ Date _____

Student's Signature _____ Date _____

NOTE: One Copy to be filed with Department Chairman

VI. General Building/Shop Electrical Wiring

A. Electrical wiring for light, power, heat and signal or control circuits, and electrically operated tools, portable appliances and devices shall be in accordance with the provisions of the National Electrical Code (NFPA 70-1971). Article 511 of the National Electrical Code shall apply to wiring and equipment within the hazardous areas.

1. Use only U.L. approved fuses, extension cords and appliances and replace when frayed or faulty.

2. Do not use extension cords as a substitute for permanent wiring or attach to building surfaces.

3. Do not run extension cords through holes in the walls, ceilings, floors, or through doorways and windows or conceal them behind building walls, ceilings or floors.

4. Extension cords cannot be spliced or be tapped into. Do not use multiple plug "octopus" cord arrangements.

5. All electrical power for equipment used by students in shops shall be controlled by emergency master shut-off switches located in at least three remote locations, capable of shutting off all power to equipment within sight in the shop. The main electrical power panel controlling all power in a shop, should be locked at all times, so unauthorized persons cannot operate power equipment without the instructors' knowledge.

6. Light switch covers, plug outlet covers, junction box covers and panel covers must be in place at all times.

7. All outlets, switches, and fixtures must be securely and rigidly affixed to structure.

8. Lighting fixtures, outlets, and appliances cannot have live parts normally exposed.

9. If fuses blow frequently, have electrician check circuit and appliances; do not use higher rated fuse than circuit is designed for.

10. All electrical motors must be kept free of accumulation of dust, dirt and debris.

11. Do not use combustible light shades or affix combustibles to lights.

12. Electrical plug outlets must be grounded and so located as not to be involved with liquid overflows or splashes.

13. Explosion proof fixtures, etc., in hazardous areas must be properly maintained 18 inches above the floor.

14. Portable lamps shall be proper explosion proof, be of nonconducting materials, have no switches or plugs in the fixture.

B. Electrical

1. Maintain all artificial lighting and replace missing lamps and light covers. (M)

2. Check operation of all emergency lights daily, wherever located, so they are always ready to function. (M)

3. Properly maintain all exit and exit directional signs so they are always lighted and visible, when building is occupied, both day and night. (M)

4. Use only U.L. approved fuses, extension cords and appliances and replace when frayed or faulty. (A)

5. Do not use extension cords as a substitute for permanent wiring or attach to building surfaces. (A)

6. Do not run extension cords through holes in the walls, ceilings, floors, or through doorways and windows or conceal them behind building walls, ceilings, or floors. (A)

7. Extension cords cannot be spliced together or have other wires tapped into them, and the use of multiple plug "octopus" cord arrangements is prohibited. (A)

8. Light switch covers, plug outlet covers, junction box covers and panel covers must be in place at all times. (M)

9. All outlets, switches, boxes and fixtures must be securely and rigidly affixed to structure. (M)

10. Lighting fixtures, lamp holders, outlets, and appliances cannot have live parts normally exposed. (M)

11. If fuses blow frequently, have electrician check circuit and appliances; do not use higher rated fuse than circuit is designed for. (M) (S)

12. Do not use combustible light shades or affix combustibles to lights. (A)

13. Do not suspend any item from any light fixture. (A)

M -- Responsibility of Maintenance Dept.
A -- All Staff
S -- General Items involving local Bd. of Education, Principal and Supervisory Staff

VII. OSHA Machine Guarding Requirements

Machine guarding is one of the most important safety considerations in a shop. Proper guarding will allow the worker to work safely as well as perform assigned tasks.

Specific guarding methods are not necessarily preferable to others, but the physical layout, type of operation and material limitations may require using certain types of guards. Any guard should not itself become a hazard.

A. There are three main types of machine guards.

1. Enclosure Guards

Full enclosure guards are preferred to all other types because access to dangerous parts is prevented. Flying or breaking parts can also be contained with this type of guard.

2. Interlocking Guards

An interlocking guard should be considered the first alternative if a full enclosure guard is not practical. An interlocking enclosure guard may be opened or removed as needed. However, there is usually an electrical interlock which makes the machine inoperable while the guard is open.

Another type of interlocking or barrier guard uses a bar or electric eye which, when tripped, stops the machine.

3. Automatic Guards

The automatic guard works independently of the machine operator, as long as the machine is in motion. Common types of automatic guards are sweep and pushaway devices. This type of guard removes the operator's hand or arm from the danger zone.

B. Listed below are some of the more common OSHA guarding requirements that apply to the school shop. For additional requirements or more specific information refer to the appropriate sections of the OSHA regulations.

1. The guard must be affixed to the machine, if possible.

2. Fans less than seven feet above the floor or working level must be guarded with mesh openings not more than one-half inch across.

3. Machines designed for a fixed location must be securely anchored.

4. All V-belts and chain drives must be completely enclosed.

5. Machines must not start automatically when power is restored after a power failure.

6. Shield the feed rolls or other movable parts of feeder attachments to protect the operator.

7. Table saws must have a hood (guard) that completely covers the saw blade at all times.

8. Except for grooving, dadoing, or rabbeting a spreader and non-kick-back fingers or dogs must be provided on a table saw.

9. Radial arm saws must have an upper hood that encloses the top portion of the blade. The sides and lower portion of the blade are guarded to the full diameter with a device that automatically adjusts to the thickness of the stock.

10. Anti-kickback fingers are also required on a radial arm saw.

11. Direction of saw blade rotation must be clearly marked.

12. Band saws must be completely enclosed except for the portion from the bottom of the guide rolls to the table.

13. Jointers may not have a knife projecting more than 1/8 inch beyond the cylinder head.

14. Jointer guards must automatically adjust themselves to cover all sections of the head on the working side of the fence and remain in contact with the work at all times. The section of the cutter head back of the fence must also be guarded.

15. Cutting heads on wood shapers must be enclosed with a cage or adjustable guard at least as great as the diameter of the cutter.

16. Feed rolls on a planer must be guarded by a hood or suitable guard to prevent the operator's hands from coming in contact with the in-running rolls.

17. The blade of a portable circular saw must be guarded above and below the base plate or shoe.

18. When the portable circular saw is withdrawn from the work, the lower guard must automatically and instantly return to a covering position.

19. Disc sanders require an enclosed disc except for the portion of the disc above the table.

20. Belt sanders require guards at each nip point where the sanding belt runs onto a pulley. The unused portion of the sanding belt must be guarded against accidental contact.

21. Wood lathes used for turning long pieces of stock held only between the two centers must have long curved guards extending over the top of the lathe to prevent the work peices from being thrown out of the lathe, if they become loose.

22. The tops and sides of the router must be covered.

23. Wheel safety guards must cover the spindle end, nut, and flange of a grinder.

24. The exposed area of a grinding wheel should not exceed more than one-fourth of the area of the entire grinding wheel.

25. Hand held electric power tools must be equipped with "dead man" or "quick-release" control so that the power can be shut off when the operator releases the control.

26. All hand-held portable electric equipment must have its frame grounded or be double insulated and identified as such.

27. The rated load of any jack must be permanently marked on it.

28. All roller-type printing machines must be equipped with nip guards.

29. Each employer shall be responsible for the safe condition of tools and equipment used by employees.

VIII. Specific Safety Considerations for Lab Areas (Preventive Maintenance)

A. Graphic Arts Technology

1. General Safety Requirements:

   a. ATTITUDE: Develop a good attitude toward safety. Work safely and carefully. A safe attitude will protect you and others.

   b. SECURE APPROVAL: Secure your instructor's approval for all work you plan to do in the shop.

   c. CLOTHING: Dress properly for your work. Remove coats. Tuck in ties. Roll up sleeves. Wear a shop apron.

   d. EYE PROTECTION: Wear safety glasses when doing any operation that may endanger the eyes, such as using type wash. Be sure that there is adequate lighting for you to see what you are doing.

   e. CLEAN HANDS: Keep the hands clean, free of grease, oil and ink.

   f. CONSIDERATION OF OTHERS: Help others in your class and group. Be sure that you are working in a safe manner so as not to endanger someone. Caution other students if they are violating a safety rule.

   g. TOOL SELECTION: Select the proper size and type of tool for your work. Be sure that they are sharp and in good condition. Tell your instructor if tools are broken, have loose handles, or need adjustments.

   h. CARRYING TOOLS: Carry sharp and pointed tools pointing downward. Do not swing your arms or put them over your head when carrying them. Do not carry sharp tools in your pockets.

   i. CLAMPING STOCK: Whenever possible, such as doing linoleum block printing, hold the work in a special holder.

   j. USING TOOLS: Hold a tool in the correct position while using it. Make sure that you push the engraving tool for block printing away from you and other students. Be careful when guiding a cut that you do not cut your fingers.

k. WORKING SPEED: Do not rush through your work. Keep a steady, unhurried pace.

l. FLOOR SAFETY: The floor around the printing presses, paper cutter and other machines should be kept free of litter. Keep all materials out of the aisles. Wipe up all spilled liquids immediately.

m. LIFTING: Lift heavy boxes of paper with your arm and leg muscles.

n. MATERIAL AND PROJECT STORAGE: Store your jobs that you are working on in the designated storage lockers. Do not leave materials out on the tables or on the floor. Paper, ink and tools should be stored in designated places.

o. BENCH ORGANIZATION: Keep your materials for your job carefully organized on your table. Keep sharp pointed tools near the center of the table. Do not pile tools on top of each other. Do not let sharp pointed tools extend out over the edge of the table. Keep drawers and cabinet doors closed.

p. FIRE PROTECTION: Use flammable liquids only in approved areas. Close cans of thinners immediately. Be sure containers are properly labeled. Dispose of all combustible materials immediately in an approved container. All flammable liquids should be stored in an approved, fire proof, metal storage cabinet.

q. INJURIES: Report all injuries to your instructor. A complete first aid kit should be in the shop at all times. No one should work without a qualified adult present.

B. Hand Tools

1. Use the right tool for the job to be performed.

2. Be sure that tools and handles are clean and free of grease or oil before using them.

3. Cutting tools should be sharp when using them. Dull tools cause accidents because of a greater force required to use them.

4. Sharp pointed and sharp edge tools should be carried pointing downward.

5. When you hand tools to others, give them with the handle first.

6. Always report damaged tools to the instructor. Damaged tools can cause injuries.

7. Tools should always be wiped free of grease or dirt after use, and they should be returned to the proper storage location.

8. Be careful not to drop heavy tools such as chases.

9. Be sure to cut away from you when cutting silk screen film or doing linoleum block printing.

10. Be careful when using a needle to sew through the side of a book when doing book binding.

C. Graphic Arts Machines

1. General Requirements:

a. Always be sure to get the instructor's approval to operate a machine.

b. Wear appropriate clothing. Remove coats. Tuck in ties. Roll up sleeves. Wear a shop apron.

c. Be wide awake and alert. Never operate a machine while you are tired or sick.

d. Think through the operation before performing it. Know how you are going to do it, and what the machine will do.

e. Make all necessary adjustments before turning on the machine. Some adjustments on certain machines will require the approval of the instructor.

f. Never remove or adjust a safety guard without the permission of the instructor.

g. Use approved safety devices. Some operations may require the use of a special jig or fixture.

h. Keep the machines, such as the printing presses, clear of tools, stock, paper and project materials. Keep the floor around the machines free of scraps, paper and excessive litter.

i. Allow the machines, such as the printing presses, to reach their full operating speed before starting to feed the paper to it.

j. Feed the machine carefully and only as fast as the machine will take the paper.

k. Maintain the MARGIN OF SAFETY specified for the machine.

l. If a machine is dull or out of adjustment or is not working properly, shut off the power immediately and inform the teacher.

m. Make sure that you are the one to control the machine. Start and stop the machine yourself. If someone is helping you, be sure they understand what you are doing and what they are expected to do and how to do it.

n. Do not allow your attention to be distracted while operating a machine. Be sure that you do not distract the attention of others who are operating machines.

o. Stay clear of other machine operators. When finished with your machine, shut it off. Never leave a machine running unattended. Do not crowd around while waiting to use a machine.

2. Specific Requirements

a. Printing Press

1. Hands should be placed only on feed or delivery board when operating printing press.

2. Always stop press to reposition a sheet of paper.

3. Do not wear long hair or loose clothing while operating press.

4. Do not operate press if you are not sure of how or you have a serious physical impairment.

5. Stop the press while adding ink to the ink disk.

6. The press is set up and operated by one person only.

7. Handle paper carefully to avoid cuts when feeding press.

8. Remove all jewelry when operating press.

9. Never leave the press running unattended.

10. Eye protection must be worn while operating press.

b. Rubber Stamp Machine

1. Be careful not to burn yourself when handling hot rubber stamp chases or matrex.

c. Paper Cutter

1. Never operate the paper cutter with another person.

2. Make sure the blade is sharp and the lock is on.

d. Stitching Machine

1. Keep fingers away from wire staples when using the power stitching machine.

2. Eye protection must be worn while using stitching machine.

e. Photo Offset Machines

1. Do not look directly at ARC or High Intensity Light.

2. Always add acid to water when mixing fixer stop bath solution.

3. Handle offset plates with care.

4. Do not lubricate offset press while it is running.

5. Do not touch dampening rollers while offset press is running.

6. Do not clean parts of offset press while it is running.

7. Shut off offset press before removing jammed sheets of paper.

8. Keep floor and work area clean around offset press.

9. Do not adjust offset press while it is running.

10. Keep exhaust fan on while working in the dark room.

11. Eye protection must be worn while operating offset press.

f. Glass Top Tables

1. Do not lean on glass top table.

2. Do not place heavy objects on glass top table.

D. Finishing Operations

1. Eye Protection must be worn while using type cleaners and solvents.

2. Dispose of all wiping rags in a closed, metal container.

3. Do not use lacquer thinner in the presence of an open flame.

4. Cleaning fluids and solvents must be stored in an approved, fire proof, labeled metal cabinet.

5. Wash hands immediately after using type cleaners and solvents.

E. Preventive Maintenance

a. A complete first aid kit (unlocked) should be in the shop at all times.

b. Never leave an injured pupil alone.

c. A pupil should never work alone in the room.

d. No work will take place if a phone to the outside is not available.

e. There shall be adequate lighting and ventilation in the room.

f. The floor shall be smooth and unwaxed.

g. Non-skid abrasive material should be applied to the floor areas around the presses and other machines.

h. The floor in the darkroom shall be of a non-electrical-conductive type.

i. There shall be "panic bar" type handles on the shop exit doors.

j. There shall be proper grounding of power driven equipment.

k. There shall be a wash-up sink and other work sinks in the room.

l. There shall be hot and cold water, paper towels and suitable hand cleaners in the room.

m. Arrangement of equipment should follow straight-line patterns with ample aisle space between rows.

n. Machines should be arranged so that projecting arms, gauges should not injure pupils.

o. Provision should be made for orderly storage of books, coats, and lunches.

p. Heavy or breakable items should be stored on the floor under shelves.

q. Never use a chair or box to reach top shelves.

r. The shop must be equipped with a phone.

s. Tote carts should be used to transport paper stock or other heavy items.

t. New classes should be given a safety tour of the shop.

u. Proper type of fire extinguishers should be used in the shop.

B. Safety for Plastics

1. All safety rules for the individual power tool must be followed.

2. Safety glasses or goggles must be worn.

3. All polishing and buffing wheels must be equipped with safety guards. The dust generated by the polishing operation, should be removed by an exhaust system, and vented to the outside of the classroom. This is required by the state health and safety regulations.

4. Safety factors to be followed while working with the solvents and cements are:

   a. Fumes from volatile liquids used may be toxic and must not be inhaled.

   b. Some cements are flammable.

   c. In all cases use cements in.a well ventilated room.

   d. Avoid contact with eyes, skin and clothing.

   e. In cases of contact with skin or clothing, immediately wash the skin with soap and water. Clothing must be washed or cleaned before reuse. If cement comes in contact with the eyes, they must be flushed out with water at once and given medical attention.

5. In heat forming plastic the temperature used may be up to 350° F. When handling plastic that has been heated, always wear heavy gloves, to keep from burning your hands.

6. Power Tool Safety

   a. Circular Saw -- Make sure the circular saw is equipped with a guard and use it. Be sure the saw is properly sharpened and set.

      Do not saw free hand. Do not reach over a saw with your hands. Use a push stick when sawing small pieces. Always stand to one side of a circular saw; never in a direct line with the saw blade.

   b. Band Saw — Check adjustments of blade tension. Adjust the blade guides properly.

Do not stop a band saw suddenly by forcing a piece of plastic against the blade.

Make turns carefully do not twist the blade. Keep saw sharp and evenly set. Avoid backing out of curves.

c. Jigsaw -- Do not adjust hold down while machine is running. Do not make sharp turns. Plan cuts so "backing out" is reduced to a minimum.

d. Metal Lathe -- Check to see that the tool holder and acrylic stock are properly clamped, and tail stock spindle is locked. DO NOT measure work or adjust a cutting tool while the lathe is running. Never leave the chuck wrench in the lathe chuck. Keep the cutting tool sharp. Be careful not to take too heavy a cut. Stand erect. Keep your face away from the flying chips and wear face mask.

e. Planer and Jointer -- Be sure the knives are sharp and free from nicks. Do not attempt to take too heavy a cut. Do not attempt to surface stock that is less than 12 inches long. Change position of your hands so that they will never be directly over the jointer knives.

f. Drill Press -- Check to make sure the chuck grips the bit tightly. Be sure the chuck key is removed before starting the press.

Do not hold small pieces by hand while drilling. Clamp small pieces to the drill table before starting the drill press.

See to it the drill is properly ground for acrylics. - Do not force drill bit. Remove drill frequently so flutes can be cleaned of chips and shavings. Do not try to stop the drill by grabbing chuck.

CONCENTRATE ON YOUR WORK WHILE USING A POWER TOOL. DO NOT VISIT WITH OTHER STUDENTS, EVEN AFTER THE POWER IS OFF. DO NOT LEAVE THE MACHINE UNTIL IT HAS STOPPED RUNNING. DO NOT ATTEMPT TO OIL, ADJUST, OR CLEAN ANY POWER TOOL WHILE IT IS RUNNING.

IF YOU ACQUIRE SAFE WORK HABITS NOW, THEY WILL SERVE YOU WELL FOR YEARS TO COME.

C. Wood Technology

1. General Requirements

a. ATTITUDE: Develop a good attitude toward safety. This means that you have a strong feeling toward the importance of safety and are willing to give time and attention to learning the safest way to perform your work. It means that you will be certain to work carefully and follow the rules — even when no one is watching you. A safe attitude will protect you and others, not only in the shop but also in activities outside of school.

b. SECURE APPROVAL: Secure your instructor's approval for all work you plan to do in the shop.

c. CLOTHING: Dress properly for your work. Remove coats, and jackets; tuck in your tie and roll up loose sleeves. It is advisable to wear a shop apron that is snugly tied.

d. EYE PROTECTION: Wear safety glasses or a face shield when doing any operation that may endanger your eyes. Be sure you have enough good light to see what you are doing without straining your eyes.

e. CLEAN HANDS: Keep your hands free of oil or grease.

f. CONSIDERATION OF OTHERS: Be thoughtful and helpful toward other students in the class. Be sure the work you are doing does not endanger someone else. Caution other students if they are violating a safety rule.

g. TOOL SELECTING: Select the proper size and type of tool for your work. An expert never uses a tool unless it is sharp and in good condition. Inform your instructor if tools are broken, have loose handles, or need adjustments.

h. CARRYING TOOLS: Keep edged and pointed tools turned down and do not swing your arms or raise them over your head while carrying them. Carry only a few tools at one time unless they are in a special holder. Do not carry sharp tools in your pockets.

i. CLAMPING STOCK: Whenever possible, mount the work in a vise, clamp, or special holder. This is especially important when using chisels, gauges, or portable electric tools.

j. USING TOOLS: Hold a tool in the correct position while using it. Most edged tools should be held in both hands with the cutting motion away from yourself and other students. Be careful when using your hand or fingers as a guide to start a cut. Test the sharpness of a tool with a strip of paper or a scrap of wood. Do not use your fingers.

k. WORKING SPEED: Do not "rush and tear" through your work. The good craftsperson knows that a steady, unhurried pace is the safest and will produce the best work.

l. BENCH ORGANIZATION: Keep your project materials carefully organized on your bench with tools located near the center. Do not "pile" tools on top of each other. Never allow the edged or pointed tools to extend out over the edge of the bench. Close your vise when it is not in use and see that the handle is turned down. Keep drawers and cabinet doors closed.

m. FLOOR SAFETY: The floor should be kept clear of scrap blocks and excessive litter. Keep projects, sawhorses, and other equipment and materials you are using out of traffic lanes. Wipe up immediately and liquids on the floor.

n. MATERIAL AND PROJECT STORAGE: Store and stack your project work carefully in assigned areas. If the storage is overhead, be sure the material will not fall off. Straighten the lumber rack when you remove a board. Do not leave narrow strips protruding from the end of the storage rack, especially at or near eye level.

o. LIFTING: Protect your back muscles when lifting heavy objects. Have someone help you and lift with your arm and leg muscles. Secure help with long boards, even though they may not be heavy.

p. FIRE PROTECTION: Apply and handle finishing materials only in approved areas. Close cans of finishing materials and thinners immediately. Use flammable liquids in very small quantities. Be sure the container is labeled. Dispose of oily rags and other combustible materials immediately or store them in an approved container. Secure the instructor's approval before you bring any flammable liquid into the shop.

q. INJURIES: Report all injuries, even though slight, to your instructor.

2. Hand Tools

a. General Requirements

1. Contributions Toward a Safe Laboratory

a. Always think "safety".

b. Wear safety glasses or goggles in danger zones or other designated areas.

c. Be careful how you handle the property of others. Respect the rights of others.

d. Report even the slightest injury. Small cuts, improperly treated, may cause serious trouble.

e. Notify your instructor of unsafe condition you observe.

f. Keep the floor clear of excessive litter and scraps of material.

g. Be sure to stack lumber so it will stand firmly.

h. Store clamped stock so it will not fall.

i. See to it that used rags are placed in safety cans.

j. Do your part in keeping finish containers tightly closed.

k. Use the dust collecting system. The air you breathe should be kept clean.

l. Safety should be an important part of every job. Safe work habits acquired now will serve you well for years to come.

2. Working Safely with Tools and Equipment

a. Ask your instructor to explain any part of your work you do not understand.

b. Assemble tool parts correctly for safe and efficient use.

c. Do not use files without handles.

d. Keep edge tools sharp.

e. Carry edge tools with edges down and keep them out of your pockets.

f. Clamp all stock securely before using any edge tools.

g. With few exceptions, cut away from you when using edge tools.

h. Report broken tools to your instructor.

i. Store tools in places provided.

j. Protect your eyes from sandpaper dust. Wipe or brush away sandpaper dust instead of using air pressure.

k. Wear rubber gloves to handle dangerous liquids.

l. Close vises so the handles do not protrude in aisles.

b. Specific Considerations

The selection of hand tools available can vary greatly among Industrial Arts wood labs from basic necessities to extravagant overloaded tool cribs. The hand tools, therefore, are listed in an attempt to call to the readers attention that specific instructions may be warranted in some circumstances.

Each and every tool listed below has been designed for a specific use. Misuse and/or abuse can lead to injury. Specific safety instruction should be considered for the following processes and related tools.

1. Sawing:

Coping Saw
Hand Crosscut Saw
Hand Ripsaw
Backsaw
Miter Box Saw

2. Boring and Drilling:

Brace
Auger Bits
Forstner Bit
Expansive Bit
Hand Drill

3. Filing, Carving and Chiseling:

Wood Files
Draw Knife
Spokeshave
Gouge
Knife
- Floyd
- Utility
- Carving

Wood Chisels

4. Planing:

Smoothing Plane
Jack Plane
Block Plane
Modelers Plane
Router Plane
Rabbet Plane
Hand Scraper

5. Fastening:

Nails
Claw Hammer
Nail Sets
Screws
Screwdrivers
Staples
Adhesives

6. Holding Devices:

Hand Screws
Bar Clamps
C-Clamps

7. Abrasives:

"Sandpaper" Sanding
Steel Wool
Polishing Compounds

8. Finishing:

Fillers
Putties
Shellac
Bleach
Stains
Sealers
Top Coat Finishes
Thinners
Spraying
Aerosol Cans
Finish Removers

3. Woodworking Machinery

a. General Requirements

1. Always be sure you have the instructor's approval to operate a machine. He knows you and the machine and can best make the decision as to whether you have "what it takes" to operate it safely.

2. Wear appropriate clothing. Remove coats or jackets; tuck in your tie and roll up loose sleeves. Wear a shop apron and tie it snugly.

3. You must be wide awake and alert. Never operate a machine when you are tired or ill.

4. Think through the operation before performing it. Know what you are going to do and what the machine will do.

5. Make all the necessary adjustments before turning on the machine. Some adjustments on certain machines will require the instructor's approval.

6. Never remove or adjust a safety guard without the instructor's permission.

7. Use approved push sticks, push blocks, feather-boards, and other safety devices. Some operations may require the use of a special jig or fixture.

8. Keep the machine tables and working surfaces clear of tools, stock, and project materials. Also keep the floors free of scraps and excessive litter.

9. Allow the machine to reach its full operating speed before starting to feed the work.

10. Feed the work carefully and only as fast as the machine will cut it easily.

11. Maintain the MARGIN OF SAFETY specified for the machine. This is the minimum distance your hands should ever come to the cutting tool while it is in operation.

12. If a machine is dull, out of adjustment, or in some way not working properly, shut off the power immediately and inform your instructor.

13. You are the one to control the operation. Start and stop the machine yourself. If someone is helping you, be sure they understand this and know what they are expected to do and how to do it.

14. Do not allow your attention to be distracted while operating a machine. Also, be certain that you do not distract the attention of other operators.

15. Stay clear of machines being operated by other students. See that other students are "out of the way" when you are operating a machine.

16. When you have completed an operation on a machine, shut off the power and wait until it stops before leaving the machine or setting up another cut. Never leave a machine running unattended.

17. Machines should not be used for trivial operations, especially on small pieces of stock. Do not play with machines. A machine or tool is not a toy.

18. Do not "crowd around" or wait in line to use a machine. Ask the present operator to inform you at your work station when he or she has finished. Common standards of courtesy may slow down a little, but they will make the shop a more pleasant and safer place to work.

b. Specific Requirements

1. Band Saw:

a. Wheel guard doors must be closed and the blade properly adjusted before turning on the machine.

b. Adjust the upper guide assembly so it is ¼ in. above the work.

c. Allow the saw to reach full speed before starting to feed the work.

d. The stock must be held flat on the table.

e. Feed the saw only as the teeth will remove the wood easily.

f. Maintain a 2 in. margin of safety. (This means that the hands should always be at least two inches away from the blade when the saw is running).

g. Plan saw cuts to avoid backing out of curves, whenever possible.

h. Make turns carefully and do not cut radii so small that the blade is twisted.

i. Stop the machine before backing out of a long curved cut.

j. Round stock should not be cut unless mounted securely in a jig or hand screw.

k. If you hear a clicking noise, turn off the machine at once. This indicates a crack in the blade. If the blade breaks, shut off the power and move away from the machine until both wheels stop.

l. Turn off the machine as soon as you have finished your work. If the machine has a brake, apply it smoothly. Do not leave the machine until it has stopped running.

2. Drill Press:

a. Check the speed setting to see that it is correct for your work. Holes over ½ in. should be bored at the lowest speed.

b. Use only an approved type of bit. Bits with feed screws or those that have excessive length should not be used.

c. Mount the bit securely to the full depth of the chuck and in the center. Remove the key immediately.

d. Position the table and adjust the feed stroke so there is no possibility of the bit striking the table.

e. The work should be placed on a wood pad when the holes will go all the way through.

f. Work that will be held by hand should be center punched.

g. Small or irregular shaped pieces must be clamped to the table or held in some special fixture.

h. Feed the bit smoothly into the work. When the hole is deep, withdraw it frequently to clear the shavings and cool the bit.

i. When using some special clamping setup, or a hole saw or fly cutter, have your instructor inspect it before turning on the power.

j. Always have your instructor check setups for routing and shaping.

3. Jointer:

a. Be sure you have the instructor's approval to operate the machine.

b. Before turning on the machine, make adjustments for depth of cut and position of fence.

c. Do not adjust the outfeed table or remove the guard without your instructor's approval.

d. The maximum cut for jointing an edge is 1/8 in. and for a flat surface, 1/16 in.

e. Stock must be at least 12 in. long. Stock to be surfaced must be at least 3/8 in. thick unless a special feather board is used.

f. Feed the work so the knives will cut "with the grain." Use only new stock that is free of knots, splits and checks.

g. Keep your hands away from the cutterhead even though the guard is in position. MAINTAIN AT LEAST 4 IN. MARGIN OF SAFETY.

h. Use a push block when planing a flat surface. Do not apply pressure directly over the knives with your hand.

i. Do not plane end grain.

j. The jointer knives must be sharp. Dull knives will vibrate the stock and may cause a kickback.

4. Lathe:

a. Before starting the machine; be sure that spindle work has the cup center properly imbedded, tail-stock and tool rest are securely clamped, and there is proper clearance for the rotating stock.

b. Before starting the machine for faceplate work, check to see that the faceplate is tight against the spindle shoulder and the tool support has proper clearance.

c. Wear goggles or a face shield to protect your eyes, especially when roughing out work.

d. Select turning speed carefully. Large diameters must be turned at the lowest speed.

e. Wood with knots and splits should not be turned. Glued-up stock should cure at least 24 hours.

f. Keep the tool rest close to the work.

g. Remove the tool rest for sanding and polishing operations.

h. Use a scraping cut for all faceplate work.

i. Remove both the spur and cup centers when they are not in use.

j. When you stop the lathe to check your work also check and lubricate the cup center.

k. Keep the lathe tools sharp, hold them firmly and in the proper position.

l. Keep your sleeves rolled up above elbows and other loose clothing away from the moving parts of the lathe and work.

5. Planer:

a. Be sure you have the instructor's permission to operate the machine.

b. Adjust the machine to the correct thickness of cut before turning on the power.

c. Stock should be at least 12 in. long or several inches longer than the distance between the centers of the feed rolls.

d. Surface only new lumber that is free of loose knots and serious defects.

e. Plane with the grain or at a slight angle with the grain. Never attempt to plane cross grain.

f. Stand to one side of the work being fed through the machine.

g. Do not look into the throat of a planer while it is running.

h. Do not attempt to feed stock of different thicknesses, side by side through the machine, unless it is equipped with a sectional infeed roll.

i. Handle and hold the stock only in an area beyond the ends of the table.

j. If the machine is not working properly, shut off the power at once and inform the instructor.

6. Radial Arm Saw:

a. Stock must be held firmly on the table and against the fence for all crosscutting operations. The ends of long boards must be supported level with the table.

b. Before turning on the motor be certain that all clamps and locking devices are tight and the depth of cut is correct.

c. Keep the guard and anti-kickback device in position. Do not remove them without your instructor's permission.

d. Always return the saw to the rear of table after completing a crosscut or miter cut. Never remove stock from the table until the saw has been returned.

e. MAINTAIN A 6 IN. MARGIN OF SAFETY. To do this you must keep your hands this distance away from the path of the saw-blade.

f. Shut off the motor and wait for the blade to stop before making any adjustments.

g. Be sure the blade has stopped and lowered before you leave the machine.

h. The table should be kept clean and free of scrap pieces and excessive amounts of sawdust.

i. Secure approval from your instructor before making ripping cuts or other special setups. When ripping stock it must be flat and have one straight edge to move along the fence.

j. When ripping, always feed stock into the blade so that the bottom teeth are turning toward you. This will be the side opposite the antikickback fingers.

7. Sanding Machines:

a. Be certain the belt or disk is correctly mounted. The belt must track in the center of the drums and platen. Do not operate the disk sander if the abrasive paper is loose.

b. Check the guards and table adjustments to see that they are in the correct position and securely locked in place.

c. Use the table, fence and other guides to control the position of the work, whenever possible.

d. Small or irregular-shaped pieces should be held in a hand clamp or some special jig or fixture.

e. When sanding the end grain of narrow pieces on the belt sander, always support the work against the table.

f. Sand only on the side of the disk sander that is moving down toward the table. Move the work along this surface so it will not burn.

g. Always use a pad or push block when sanding thin pieces on the belt sander.

h. Do not use power sanders to form and shape parts where the operations could be better performed on other machines.

i. Sand only clean new wood. Do not sand work that has excess glue or finish on the surface. These materials will load and foul the abrasive.

8. Scroll Saw: (Jig Saw)

a. Be certain the blade is properly installed in a vertical position with the teeth pointing down.

b. Roll the machine over by hand to see if there is clearance for the blade and if the tension sleeve has been properly set.

c. Check the belt guard to see that it is closed and tight.

d. Keep the holddown adjusted so the work will not be raised off the table.

e. When the saw is running, do not permit your fingers to get directly in line with the blade.

9. Shaper:

a. Be sure to get the insturctor's permission before starting to set up and use the machine.

b. When possible, mount the cutter so that most of the cutting will be performed on the lower part of the edge. Any unused part of the cutter should be below the table.

c. An approved lock washer must be located directly under the spindle nut and the nut must be set tight.

d. Use the fence for all straight line shaping cuts and be certain it is properly adjusted and securely locked in place.

e. Use guards, feather bords, and holddown devices whenever possible.

f. Maintain a 4 in. margin of safety when using the fence or miter gauge and a 6 in. margin when using depth collars. If the part is too small to allow this margin, design and build a special holder or push board.

g. Cut only new stock that is straight and true and free of splits, checks, and knots.

h. Roll the spindle over manually to check clearance of complicated settings. Snap the switch on and off quickly to check rotation of the cutter. Be certain the direction of feed is correct.

i. Have your instructor inspect the setup and inform him of the direction and order of feed you plan to use.

j. Make a trial cut on an extra piece of stock that is the same thickness as your project work.

10. Table Saw:

a. Be certain the blade is sharp and the right one for your work.

b. The saw is equipped with a guard and a splitter. Be sure to use them.

c. Set the blade so it extends about ¼ in. above the stock to be cut.

d. Stand to one side of the operating blade and do not reach across it.

e. MAINTAIN A 4 IN. MARGIN OF SAFETY. (Do not let your hands come closer than 4 in. to the operating blade even though the guard is in position.)

f. Stock should be surfaced and at least one edge jointed before being cut on the saw.

g. The position of the stock must be controlled either by the fence or the miter guage. NEVER CUT STOCK FREE HAND.

h. Use only new stock that is free of knots, splits, and warp.

i. Stop the saw before making adjustments to the fence or blade.

j. Do not let small scrap cuttings accumulate around the saw blade. Use a push stick to move them away.

k. Resawing and other special set-ups must be inspected by the instructor before power is turned on.

l. The dado or any special blades should be removed from the saw after use.

m. Students helping to "tail-off" the saw should not push or pull on the stock but only support it. The operator must control the feed and direction of the cut.

n. As you complete your work, turn off the machine and remain until the blade has been lowered and stopped. Clear the saw table and place waste cuttings in the scrap box.

4. Portable Power Equipment

a. General Requirements

1. Do not attempt to oil, clean, adjust or repair any power tool while it is running.

2. Always wear proper clothing and safety goggles.

3. Do not operate any portable tool unless authorized to do so by the instructor, or under supervision.

4. Do not try to stop any portable tools with your hands or body.

5. Always see that work and cutting tools on any portable tools are clamped securely before starting.

6. Concentrate on the work and do not talk unnecessarily while operating portable equipment.

7. Select a location that is dry and not grounded for using a portable electric tool or appliance, so as to avoid serious electric shock.

8. Remove the chuck key or other adjusting device before turning on the power.

9. Be sure the switch is in "off" position before plugging into socket.

10. When finished with a portable electric tool, turn off switch and hold equipment firmly until it comes to a stop.

b. Specific Requirements

1. Circular Saw: (Portable Saw)

a. Stock must be well supported in such a way that the kerf will not close and bind the blade, during the cut or at the end of the cut.

b. Thin materials should be supported on benches. Small pieces should be clamped in a vise or onto a bench top or sawhorse.

c. Be careful not to cut into the bench, sawhorse or other supporting devices.

d. Adjust the depth of cut to the thickness of the stock, plus about 1/8 in.

e. Check the base and angle adjustment to be sure they are tight. Plug in the cord to a grounded outlet and be sure it will not become fouled in the work.

f. Always place the saw base on the stock with the blade clear before turning on the switch.

g. During the cut, stand to one side of the cutting line.

h. Large saws will have two handles. Keep both hands on them during the cutting operation. Small saws should also be guided with both hands when possible.

i. Always unplug the machine to change blades or make adjustments.

j. Always use a sharp blade that has plenty of set.

2. Drill:

a. Select the correct drill or bit for your work and mount it securely to the full depth of the chuck.

b. Stock to be drilled must be held in a stationary position so it cannot be moved during the operation.

c. Connect the drill to a properly grounded outlet.

d. Turn on the switch for a moment to see if the bit is properly centered and running true.

e. With the switch off, place the point of the bit in the punched layout layout hole.

f. Hold the drill firmly in one or both hands and at the correct drilling angle.

g. Turn on the switch and feed the drill into the work. The pressure required will vary with the size of the drill and the kind of wood.

h. During the operation, keep the drill aligned with the direction of the hole.

i. When drilling deep holes, especially with a twist drill, withdraw the drill several times to clear the cuttings.

j. Follow the same precautions and procedures as when drilling holes with a hand drill or the drill press.

k. Always remove the bit from the drill as soon as you have completed your work.

3. Saber Saw:

a. Make certain the saw is properly grounded through the electrical cord.

b. Select the correct blade for your work and be sure it is properly mounted.

c. Disconnect the saw to change blades or make adjustments.

d. Place the base of the saw firmly on the stock before starting the cut.

e. Turn on the motor before the blade contacts the work.

f. Do not attempt to cut curves so sharp that the blade will be twisted.

g. Make certain the work is well supported and do not cut into sawhorses or other supports being used.

4. Router:

a. The bit must be securely mounted in the chuck to a depth of at least ½ in. and the base must be tight.

b. As with all portable tools, be certain that the motor is properly grounded.

c. Wear eye protection when using the router.

d. Be certain the work is securely clamped and that it will remain stationary during the routing operation.

e. Place the router base on the work or template with the bit clear of the wood before turning the power on. Hold it firmly when turning on the motor to overcome starting torque.

f. Hold the router in both hands and feed it smoothly through the cut in the correct direction.

g. When the cut is complete, turn off the motor and do not lift the machine from the work until the motor has stopped.

h. Always unplug the motor when mounting bits or making adjustments.

5. Finish Operations

Most finishing materials are combustible. Many are volatile (vaporize rapidly) so only a spark is needed to cause a fire or an explosion. Every precaution should be made to eliminate or control these hazards. Keep volatile materials in closed metal containers.

Store rags soiled with finishing materials in closed metal containers. Open flames or any equipment that might cause sparks should not be allowed in the area. An approved type of fire extinguisher should be available and its operation should be made clear to everyone. The extinguisher should be inspected periodically.

Always be sure there is adequate ventilation and keep solvent vapors at a minimum not only because of the fire hazard but also the health hazard that is involved. Inhalation (breathing) of concentrated vapors may be injurious. Prolonged contact of some materials with the skin is harmful so wash your hands often and prevent direct contact as much as possible. Wear rubber gloves for bleaching operations.

The characteristics and methods of application for a finishing material may vary somewhat from one brand to another. Read and follow the manufacturer's recommendations printed on the label of the container or in their instruction booklets.

Below is a list of general directions that you should follow as you perform your finishing operations.

a. Clean up your materials and return them to their proper place as soon as you have finished your work.

b. Close containers by first wiping out the lip and then sealing the lid tightly. Wipe off the outside. Open containers by prying carefully all the way around the lid.

c. Keep storage shelves in order with materials in their proper places and labels turned to the front.

d. Clean brushes carefully and return them to their place of storage.

e. Clean any working surfaces that you have used.

f. Rags that contain finishing materials should be discarded by storing them in a metal container.

g. Store your project in an approved location.

h. Use care while working around other students' projects. Do not touch wet surfaces or "splatter" them with a finish you are using.

i. Do not use the finishing area for sanding, rubbing or polishing a finish.

j. The finishing room is designed for the mixing, application, and drying of finishes. Its use should be restricted to these activities.

6. Preventive Maintenance

The chance of an accident is greatly increased when broken, worn and dull tools or machines are used.

Practically all manufacturers supply parts, repair kits, and instructions for servicing and maintenance without the expertise of a qualified mechanic.

Tools and equipment which cannot be repaired to specifications should be removed from service until they can be completely restored.

Certain hand tools are not repairable and should be discarded.

D. Metal Technology

1. General Requirements

a. ATTITUDE: Develop a good attitude toward safety. This means that you have a strong feeling toward the importance of safety and are willing to give time and attention to learning the safest way to perform your work. It means that you will be certain to work carefully and follow the rules -- even when no one is watching you. A safe attitude will protect you and others, not only in the shop, but also in activities outside of school.

b. SECURE APPROVAL: Secure your instructor's approval for all work you plan to do in the shop.

c. CLOTHING: Dress properly for your work. Remove coats, and jackets; tuck in your tie and roll up loose sleeves, and remove jewelry. It is advisable to wear a shop apron that is snugly tied.

d. EYE PROTECTION: Wear safety glasses or a face shield when doing any operation that may endanger your eyes. Be sure you have enough good light to see what you are doing without straining your eyes.

e. CLEAN HANDS: Keep your hands free of oil or grease.

f. CONSIDERATION OF OTHERS: Be thoughtful and helpful toward other students in the class. Be sure the work you are doing does not endanger someone else. Caution other students if they are violating a safety rule.

g. TOOL SELECTION: Select the proper size and type of tool for your work. An expert never uses a tool unless it is sharp and in good condition. Inform your instructor if tools are broken, have loose handles, or need adjustments.

h. CARRYING TOOLS: Keep edged and pointed tools turned down and do not swing your arms or raise them over your head while carrying them. Carry only a few tools at one time unless they are in a special holder. Do not carry sharp tools in your pockets.

i. CLAMPING STOCK: Whenever possible, mount the work in a vise, clamp, or special holder. This is especially important when using chisels, hacksaws, or portable electric tools.

j. USING TOOLS: Hold a tool in the correct position while using it. Most edged tools should be held in both hands with the cutting motion away from yourself and other students. Be careful when using your hands or fingers as a guide to start a cut. Test the sharpness of a tool with a strip of paper. Do not use your fingers.

k. WORKING SPEED: Do not "rush and tear" through your work.

l. BENCH ORGANIZATION: Keep your project materials carefully organized on your bench with tools located near the center. Do not "pile" tools on top of each other. Never allow the edged or pointed tools to extend out over the edge of the bench. Close your vise when it is not in use and see that the handle is turned down. Keep drawers and cabinet doors closed.

m. FLOOR SAFETY: The floor should be kept clear of scrap metal and shavings and excessive litter. Keep projects, metal, and other equipment and materials you are using out of traffic lanes. Wipe up immediately any liquids spilled on the floor.

n. MATERIAL AND PROJECT STORAGE: Store and stack your project work carefully in assigned areas. If the storage is overhead, be sure the materials will not fall off. Straighten the metal rack when you remove a piece of metal. Do not leave sheet metal protruding from the end of the storage rack, especially at or near eye level.

o. LIFTING: Protect your back muscles when lifting heavy objects. Have someone help you; lift with your arm and leg muscles. Secure help with long band iron, even though they may not be heavy.

p. FIRE PROTECTION: Appiy and handle finishing materials only in approved areas. Close cans of finishing materials and thinners immediately. Use flammable liquids in very small quantities. Be sure the container is labeled. Dispose of oily rags and other combustible materials immediately in an approved container. Secure the instructor's approval before you bring any flammable liquid into the shop.

q. INJURIES: Report all injuries, even though slight, to your instructor.

2. Hand Tool Safety Rules

a. GRINDERS: Pedestal Type

1. Stand to one side out of line of wheel when starting.

2. The face of the wheel must be flat and free from grooves.

3. Work should be fed slowly and gradually. Using too much pressure, or striking wheel suddenly, may cause it to break.

4. Make sure that the tool rest is only 1/8 inch from the face of the wheel. Frequently check this distance. Too much clearance may cause job to jam the wheel and break it.

5. Do not set tool rest while machine is in motion.

6. Use the face of wheel only, unless it is designed for grinding on the side; otherwise, side pressure may break the wheel. Whenever possible, use entire face of wheel to avoid grooving.

7. Never use a grinding wheel that is loose on the shaft or if its rate of speed is not safe for the number of r.p.m. of the spindle. Check with the teacher for this information.

8. Stop wheel if it chatters or vibrates excessively. This may be a danger signal that the wheel is not properly balanced or not attached securely to spindle.

9. All wheels should be tested for soundness. The teacher usually does that.

10. Hold job against wheel firmly so that it will not slip out of the hand and cause hands and fingers to come in contact with the wheel.

11. Use clamp or other suitable holding devices for grinding short pieces.

12. Always use face shield or goggles even if grinder is provided with protective glass shields.

b. SURFACE TYPE

1. Be sure magnetic chuck is thoroughly clean.

2. Test holding power of chuck before starting the machine.

3. Stand to one side of wheel before starting up.

4. Check to see that wheel properly clears work.

c. HAND TOOLS: Screwdrivers

1. Select screwdrivers to fit the screw head being used.

2. Keep screwdriver handles smooth.

3. Do not use a hammer on a screwdriver handle.

4. Avoid holding work in the hand when using a screwdriver on it, as it may slip and cause stab wounds.

5. Never grind a screwdriver to a chisel edge.

d. WRENCHES:

1. Discard wrenches that are spread.

2. Select open-end wrenches to fit the job.

3. Where possible, avoid using an adjustable or monkey wrench.

4. If a wrench has become burred, grind off the rough spots to avoid cutting the hands.

5. It is generally safer to pull a wrench toward yourself than to push it away from you.

6. Be sure that your knuckles will clear obstructions when the wrench turns.

e. HAMMERS:

1. Hammers that are chipped should be discarded.

2. Never use a hammer that has a loose or split handle.

f. CHISELS:

1. In using a chisel and hammer, keep the chisel head free from burring by grinding it if necessary.

2. Where chips may fly, use a chip screen.

3. Hold the chisel and hammer firmly and keep the chisel head and the face of the hammer clean and free from grease.

g. SCRAPERS:

1. Keep scrapers in a place away from the rest of the tools.

2. Keep guards from handles on all scrapers. Guard against scraping towards the body.

3. Avoid holding work in one hand and the scraper in the other; stab wounds are likely to result.

4. Scrapers that must be carried in a tool box should be guarded with a wooden or leather sheath for their own protection as well as yours.

h. FILES:

1. Always use a file with a handle.

2. When filing on the lathe, learn to file left handed.

3. Keep the file and your hand clear of the chuck jaws or dog.

4. Do not use a file as a pry bar.

5. If filing on a lathe, do not use a pad of cloth or waste under the thumb on the end of the file.

6. Keep a firm grip on the file at all times.

7. Do not blow filings so that they can go into anyone's eyes.

i. HACKSAW:

1. Use the correct blade for the job.

2. See that the blade is correctly secured in the frame.

3. When the saw breaks through the work, ease up on the pressure, so that the hand will not strike the work or vise.

4. Be sure that the work is held securely in the vise.

5. Do not force cut.

j. TAPS AND DIES:

1. Be sure work is firmly mounted in vise.

2. Secure the proper size of tap wrench.

3. Avoid cutting the hands on a broken tap end.

4. If a broken tap is removed by using a punch and hammer, wear goggles.

5. If a long thread is cut with a hand die, keep the arms and hands clear of the sharp threads coming through the die.

3. Metal Machinery

a. General Requirements

1. Always be sure you have the instructor's approval to operate a machine.

2. Wear appropriate clothing. Remove coats or jackets; loose jewelry, tuck in your tie and roll up loose sleeves. Wear a shop apron and tie it snugly. Always wear safety glasses, goggles or shield.

3. You must be wide awake and alert. Never operate a machine when you are tired or ill.

4. Think through the operation before performing it. Know what you are going to do and what the machine will do.

5. Make all the necessary adjustments before turning on the machine. Some adjustments on certain machines will require the instructor's approval.

6. Never remove or adjust a safety guard without the instructor's permission.

7. Keep the machine and working surfaces clear of tools, stock, and project materials. Also keep the floor free of scraps and excessive litter.

8. Allow the machine to reach its full operating speed before starting to feed the work. Determine correct cutting speeds.

9. Feed the work carefully and only as fast as the machine will cut it easily.

10. Maintain the MARGIN OF SAFETY specified for the machine. This is the minimum distance your hands should ever come to the cutting tool while it is in operation.

11. If a machine is dull, out of adjustment, or in some way not working properly, shut off the power immediately, and inform your instructor.

12. You are the one to control the operation. Start and stop the machine yourself. If someone is helping you, be sure they understand this and know what they are expected to do and how to do it.

13. Do not allow your attention to be distracted while operating a machine. Also, be certain that you do not distract the attention of other machine operators.

14. Stay clear of machines being operated by other students. See that other students are "out of the way" when you are operating a machine.

15. When you have completed an operation on a machine, shut off the power and wait until it stops before leaving the machine or setting up another cut. Never leave a machine running unattended.

16. Machines should not be used for trivial operations, especially on small pieces of stock. Do not play with machines. A machine or tool is not a toy.

17. Do not "crowd around" or wait in line to use a machine. Ask the present operator to inform you at your work station when he or she has finished. Common standards of courtesy may slow you down a little, but they will make the shop a more pleasant and safer place to work.

b. Specific Requirements

1. Abrasive Belt Sander Safety Rules

a. Adjust table to desired angle.

b. Check belt for proper tension.

c. Metal must rest on table.

d. Apply light pressure when sanding.

e. Take care not to bring fingers in contact with abrasive.

f. Do not clean machine when running.

2. Band Saw Safety Rules

a. When turning on power, stand to one side of saw frame, then adjust speed to suit work.

b. When saw is operating, do not bend over it.

c. Mount work only when saw is stopped.

d. Support protruding end of long work so material cut off will not fall and possibly injure anyone. Be sure that the protruding end is well guarded against anyone coming in contact with it.

e. When using the sliding stock guide, do not allow fingers to project beyond the end so that they could come in contact with the saw teeth.

f. Be sure that the blades for both circular and band saws are in good condition before using. An indication that the blade is cracked is a sharp, regular clicking sound as the work is fed. Change the blade at once if this condition arises.

g. Always inspect blade before using.

h. If blade does break in work, shut off the power and do not attempt to disengage blade from work until the machine has come to a complete stop.

3. Buffer Safety Rules

a. Have safety shields over wheels.

b. Hold work below the center of the wheel.

c. Wear proper safety protection and apron.

d. Keep a good hold on metal being polished so it will not catch and pull your hands into the wheel.

4. Drill Press Safety Rules

a. Use drills properly sharpened to cut to the right size and see that the drill is running true.

b. Small drills should revolve at high speeds, large drills at low speeds. Reduce speed about 50 per cent when drilling cast iron.

c. Chuck wrenches must be removed from drill chucks before starting the machine.

d. Never attempt to hold work under the drill by hand. Always clamp work to table.

e. Run drill only at proper speed; forcing or feeding too fast may result in broken or splintered drills and serious injuries.

f. Change belt for speed regulation only when power is "Off" and machine has come to a dead stop.

g. If work should slip from clamp, never attempt to stop it with the hands. Stop the machine and make adjustments.

h. If drill stops in work, shut off the motor and start drill by hand.

i. File or scrape all burrs from drilled holes.

j. Do not reach around or in back of a revolving drill.

k. Keep your head back and well away from ANY moving part of the drill press.

5. Engine Lathe Safety Rules

a. Before turning on the power, check to see that the tailstock, tool holder, and job are properly clamped.

b. Use hand power only when putting on or removing chuck or faceplate. Do not use the power that operates the lathe.

c. When assembling or removing the chuck, place board on ways to prevent damage to machine and possibly to operator in case the chuck falls. Have firm grip on chuck as it nears the end of the thread.

d. Do not leave chuck wrench or any other tool in the chuck. If machine is turned on, wrench may fly out and injure the operator or any other person.

e. Do not use wrench on revolving work or parts.

f. Never try to measure work or feel the edge, or adjust a cutting tool when lathe is running.

g. Do not take heavy cuts on long slender work. Doing so may cause the job to fly out of the machine.

h. When filing, be sure tang of file is protected by a strong wooden handle. Stand to one side so that, if the file is forced upward, it will go past the body rather than against it.

i. As a general rule, do not shift or change gears while lathe is running.

j. Stand erect. This keeps head away from flying chips.

6. Grinder: (Pedestal type) Safety Rules

a. Stand to one side out of line of wheel when starting it up, new.

b. The face of the wheel must be flat and free from grooves.

c. Work should be fed slowly and gradually. Using too much pressure, or striking wheel suddenly, may cause it to break.

d. Make sure that the tool rest is only 1/8 inch from the face of the wheel. Frequently check this distance.

e. Do not set tool rest while machine is in motion.

f. Use face of wheel only, unless it is designed for grinding on the side; otherwise, side pressure may break the wheel. Whenever possible, use entire face of wheel to avoid grooving.

g. Never use a grinding wheel that is loose on the shaft or if its rate of speed is not safe for the number of r.p.m. of the spindle. Check with the teacher for this information.

h. Stop wheel if it chatters or vibrates excessively. This may be a danger signal that the wheel is not properly balanced or not attached securely to spindle.

i. All wheels should be tested for soundness. The teacher usually does that.

j. Hold job against wheel firmly so that it will not slip out of the hand and cause hands and fingers to come in contact with the wheel.

k. Use clamp or other suitable holding devices for grinding short pieces.

l. Always use face shield or goggles even if grinder is provided with protective glass shields.

7. Grinder (Surface type) Safety Rules

a. Be sure magnetic chuck is thoroughly clean.

b. Test holding power of chuck before starting the machine.

c. Stand to one side of wheel before starting up.

d. Check to see that wheel properly clears work.

8. Milling Machine Safety Rules

a. Make sure that the cutter and arbor are secure and that cutter and arbor support clear the work.

b. Use only cutters that are correctly ground and in good condition.

c. To avoid striking hands on cutter while setting up, move table with work as far away from cutter as possible.

d. When using cutters in a vertical milling machine, do not take an excessively heavy cut or feed. Such a feed or cut could break the cutter and injure operator.

e. Do not try either to tighten or to take off arbor nut by applying power to machine. Make sure motor is "Off".

f. Check speeds and feeds, and feed work against direction in which cutter is rotating.

g. Keep hands away from work when machining.

h. Never reach over a revolving cutter, especially the side of cutter which cuts into the work.

i. Use a brush not the hands to remove chips.

9. Shaper Safety Rules

   a. Be sure ram, tool head, tool, work, table-support clamping screws, and vise are properly secured in place, or position, and that the tool head and tool clear the work before starting the shaper. Place a metal shield or heavy, close-mesh wire screen over the tool to catch the chips.

   b. After setting the stroke length and position, check to see that adjusting nuts are tight.

   c. Remove all wrenches from machine after completing setup.

   d. If magnetic chuck is used, be sure current is "On" before starting machine.

   e. Stand parallel to direction of stroke of machine when it is running and never reach across the table between strokes of the ram.

   f. Never remove chips while ram is in motion.

10. Spinning Lathe Safety Rules

   a. Beware of sharp-pointed metal edges when cutting the metal disc to size and when getting it ready for spinning.

   b. Check over the spinning lathe to be certain that it is in a safe condition for spinning.

   c. Be sure the tool post is securely tightened in place before attempting to spin.

   d. Always wear goggles.

   e. Remove all burrs formed during the trimming operation with a file.

   f. Make certain the spinning tools are fitted solidly to the bundle.

   g. Never stand in line with the disc during the centering operation.

h. Always double check the condition of the follow block on the disc. Remember to re-tighten the tailstock after the disc has been centered.

i. Use care when handling a disc that has been annealed and may still burn you if you do not use tongs or wear gloves.

j. Do not attempt to do spinning unless you are positive of what must be done and how it is to be done. Seek help if you are in doubt or do not know a specific operation.

4. Portable Power Equipment

a. General Requirements

1. Do not attempt to oil, clean, adjust or repair any power tool while it is running.

2. Always wear proper clothing and safety goggles.

3. Do not operate any portable tool unless authorized to do so by the instructor, or under supervision.

4. Do not try to stop any portable tools with your hands or body.

5. Always see that work and cutting tools on any portable tools are clamped securely before starting.

6. Keep the floor clear of metal chips or curls and waste pieces.

7. Get help for handling long or heavy pieces of material.

8. Concentrate on the work and do not talk unnecessarily while operating portable equipment.

b. Portable Electric Tools Safety Rules

1. Select a location that is dry and not grounded for using a portable electric tool or appliance, so as to avoid serious electric shock.

2. Remove the chuck key or other adjusting device before turning on the power.

3. Be sure the switch is in "off" position before plugging into socket.

4. Support work securely before using portable electric tools.

5. When finished with a portable electric tool, turn off switch and hold equipment firmly until it comes to a stop.

5. Welding Safety Rules

a. Gas Welding - (Oxygen-Acetylene)

1. Wear approved goggles when welding. The lenses are made in different degrees of density; select the lenses that are best suited for you.

2. Never light the torch with matches. Use a spark-lighter.

3. Do not allow anyone to watch you weld unless they wear suitable goggles.

4. It is only necessary to turn off the torch if you are going to reposition the work; however, the entire unit should be turned off if the welding job is completed. Carefully hang up the torch.

5. Never light the torch with both valves open.

6. For added protection, wear welder's gloves, leather apron, and sleeves when welding.

7. Never attempt to blow dirt off your clothing with gas pressure. The clothing will become saturated with oxygen and/or acetylene and will literally explode if a spark comes in contact with it.

b. Arc Welding

1. NEVER arc weld or watch arc welding being done without using a protective shield made specifically for Arc welding.

2. Wear goggles when chipping slag.

3. Wear approved clothing for welding.

4. Do not weld where solvent or paint fumes may collect. Remove all flammable materials from the welding area.

5. Weld only in a well-ventilated area.

6. Report any cuts or burns promptly to instructor.

7. Wear goggles under the shield for additional protection.

8. Do not weld containers until you can determine whether they stored flammable liquids. If they have, get them steam cleaned or fill them with water before welding.

c. Spot Welding

1. Wear goggles and gloves.

2. Select proper setting for material being used.

3. Weld only in well ventilated area.

4. Treat any cuts or burns promptly.

6. Finish Operations Safety Rules

a. Read instructions on finish container and follow them carefully.

b. Wash your hands after applying finish or using solvents to clean the work.

c. Examine the work for rough edges and burrs before attempting to clean it.

d. Use a well-ventilated area to apply finishes.

e. Keep open flames and sparks away from areas where finishes are being applied or solvents being used.

f. Use a filter mask when spraying finishes.

g. Wear goggles when buffing.

h. Secure immediate medical attention if solvents or foreign matter get into your eye.

i. Clean up any spilled solvents or finishes.

j. Dispose of used waste or wiping cloths by placing them in steel approved safety cans.

7. Preventative Maintenance

a. Put tools not in use in a safe place while you are working.

b. Put tools away when you are through with them.

c. Have an assigned place for each tool.

d. Do not leave sharp tools protruding from bench.

e. Always use the right tool for the job.

f. Handle precision measuring tools with great care.

g. Wipe precision tools clean of finger prints after using and keep in separate boxes or cases.

h. Apply a light dressing of oil on precision tools when in storage.

i. Keep tools sharp.

j. Use proper speeds for cutting tools.

k. Keep machines properly oiled and cleaned at all times.

l. Use the right kind of tool material for the purpose of the tool.

m. Use a tool with the correct hardening heat-treatment.

n. Use a correctly designed tool.

o. Properly apply the tool in the machine and use a proper coolant and lubricant.

p. Keep all hand tools and machines in proper working condition.

E. Drafting

1. General Drafting Room Suggestions

   a. Adequate cabinet space with large enough shelves to accommodate drawings.

   b. Bookcase for storage of reference materials.

   c. Cabinets for storage of instruments and materials for daily use.

   d. Cabinets for storage of instruments and materials for an indefinite period of time.

   e. Class room equipped for use of motion pictures, film strips, and overhead projector.

   f. Washing facilities with hot and cold water.

   g. First aid box and information clearly labeled.

   h. Chalk boards and tack boards are secured in place.

2. Specific Drafting Room Suggestions

   a. Color — See attached

   b. Lighting

   c. Sound — Consult written material and specialist in each area.

   d. Space

   e. Storage

   f. Ventilation

3. General Equipment Suggestions

   a. Equipment List — *Attached

4. Specific Equipment Precautions Suggestions

   a. Compass: Keep points covered and compass closed when not in use.

b. Dividers:

c. Paper cutter: Keep fingers away from cutting edge. Do not cut too much paper at one time. One operator only. Keep knife blade down and locked in place when not in use.

d. Trimming Shears:

e. Knife set:

f. Reproduction machine: ventilated

Space Requirements in the Drafting Room

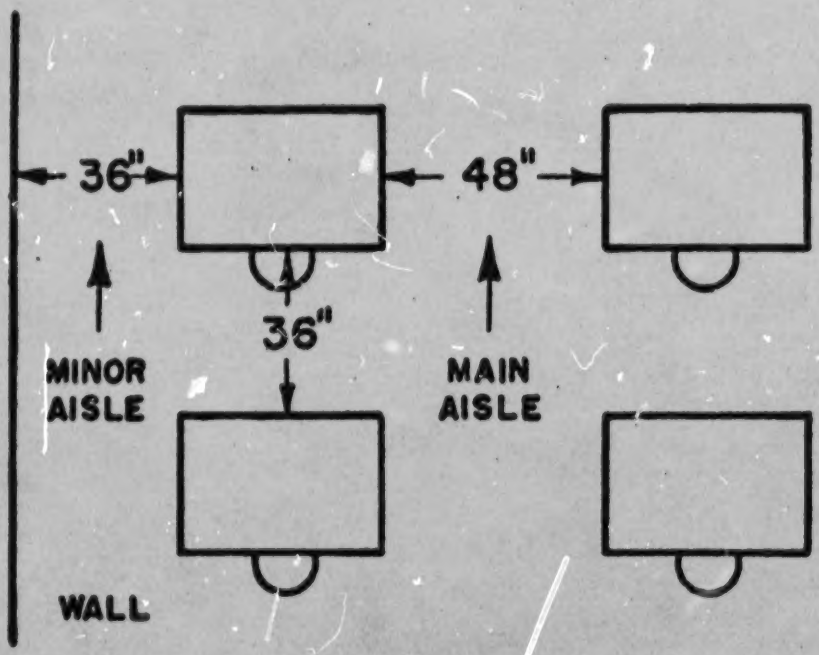
EVEN in the drafting room it is important that adequate space be provided around every work station. Although the need for safety precautions here is relatively less acute than it is in the shops where machinery constitutes a major part of the equipment, sufficient space is necessary to permit good working conditions.

It is advisable to provide adequate space both behind the drafting table and in places adjacent to the aisle in order to eliminate any accidental jostling of a T-square or triangle by a passing pupil. The standards suggested here are believed sufficient to provide that freedom of action which is so necessary to drafting.

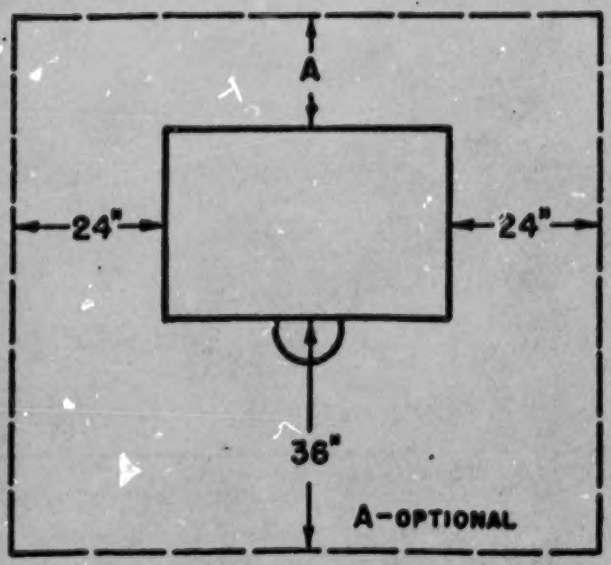
While the eight work stations presented in the drawings may include pieces of equipment not present in all shops, the diagrams can serve as a guide when and if such equipment is added to the shop.

It is also likely that the size of some drafting rooms now in use may not permit allowing as much space as is set forth in the standards. In such drafting rooms the standards should be adhered to as closely as possible. In new installations, however, the standards should definitely be insisted upon.

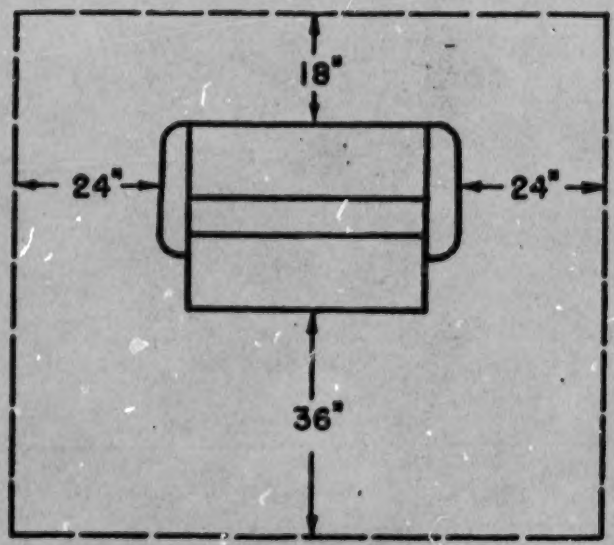
For other suggestions to be followed in planning a modern and efficient drafting room see the check lists on pages 41 to 44.



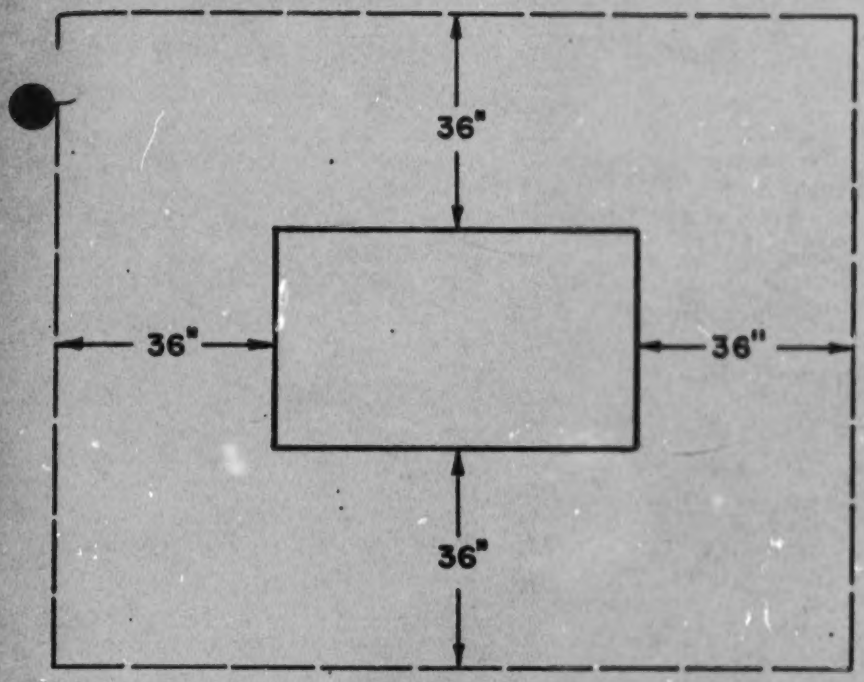
DRAWING TABLES



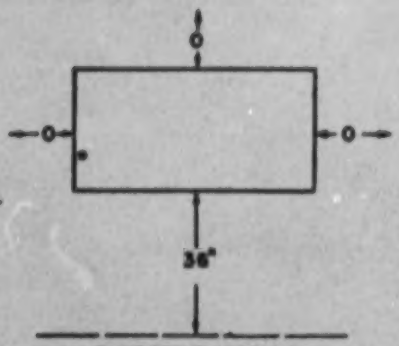
DRAWING TABLE



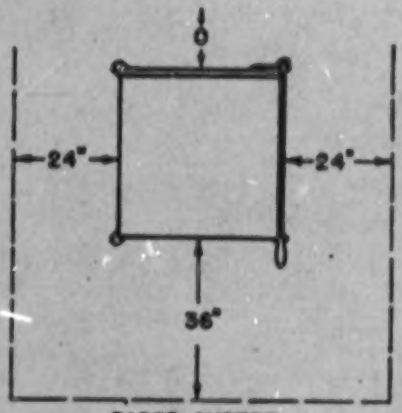
BLACK OR COLORED LINE REPRODUCTION PRINTERS



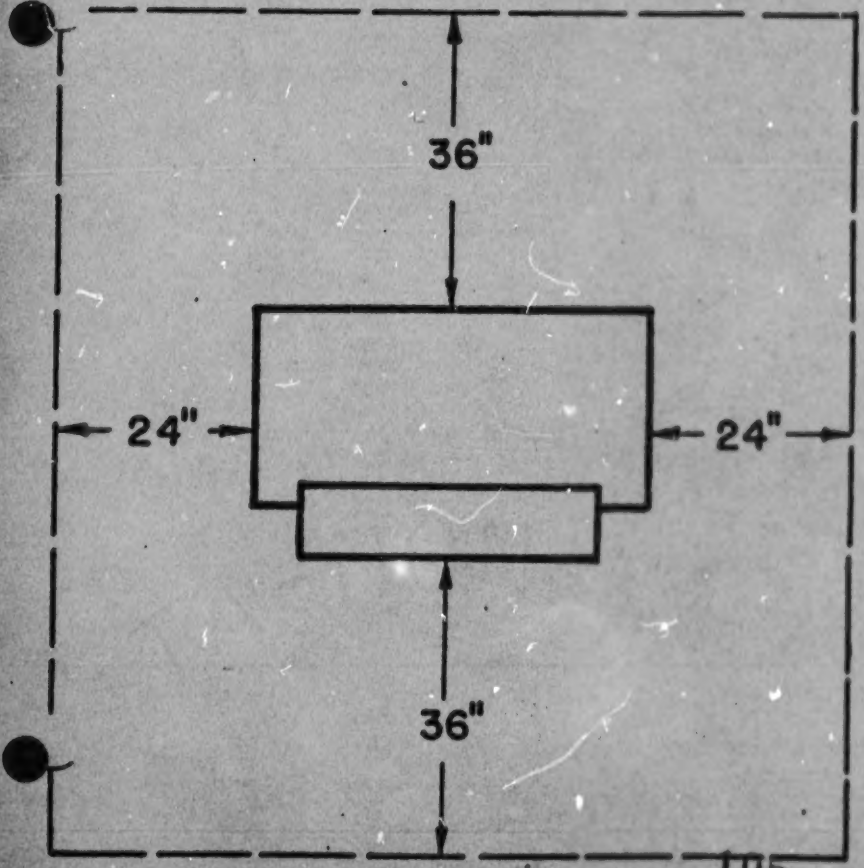
WORK TABLE



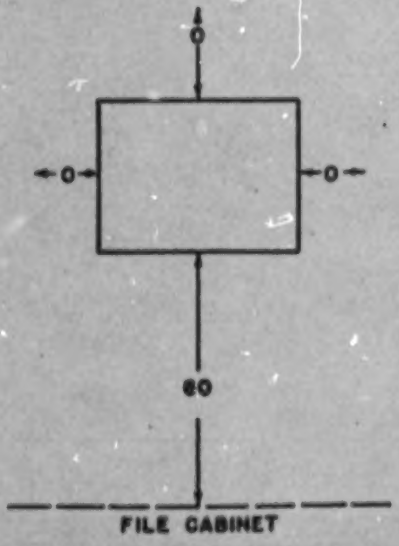
BLUEPRINT WASHER



PAPER CUTTER



BLUEPRINT MACHINE



FILE CABINET

(NOTE: The broken line around most of the drawings does not necessarily indicate painted lines on the floor for aisle purposes. The area between machine and broken line represents the work space recommended.)

Equipping the Drafting Room

THE following is adapted from the basic equipment list for drafting prepared for the North Carolina Industrial Education Centers.

Provisions are for a class of 24 students.

INSTRUMENTS AND TOOLS

Item	*Quantity*
Blackboard set	1
Chalkboard machine	1
Board, drawing, 18" x 24"	24
Instrument sets	24
Compass, bow	24
Compass, beam	1
Circular protractors	2
Cutters, 24" x 24"	2
Curves, irregular French (set)	1
Dust brushes	24
Drafting machine	9
Edging machine	1
Erasing shields	24
Lettering instrument	24
Lettering set	1
Map measures	1
Mobile parallel ruling units	8
Pencil sharpeners	2
Proportional divider	1
Pointers, pencil	24
Scale, engineer's, 18"	1
Scales, 18"	9
Scales, 12"	9
Scales, triangular hardwood, 12"	24
Triangles, 10", 30°/60°	24
Triangles, 8", 45°/90°	24
T-squares, 36"	24
Templates, assortment determined by most frequent usage	18
Trimming shears	1
Rules, adjustable curve	1

FURNITURE AND ROOM EQUIPMENT

Copy printer, diazo, 42" or 30" white printer	1
Covers, board, 37½" x 60"	24
Drafting desks, 37½" x 66"	24
Chairs, high desk, adjustable, with back	12
Chairs, high desk, adjustable, without back	24
File, flat drawers, 50" x 38"	2
Closed base for above file	2
Storage cabinet, swinging door style, 36" x 24" x 78", w/lock	1
File cabinet	1

THE following list of equipment for teaching structural drafting is from a list prepared by the Engineering Extension Service of the Texas A. and M. University System. It is presumed that the regular drawing equipment is already present.

STRUCTURAL DRAFTING EQUIPMENT

Beam compass, 18"	2
Bookcase, with lock	1
File, drawing, five drawer	1
Pencil sharpener, draftsman	1
Pencil sharpener, ordinary	1
Pointers, lead, abrasive type	6
Reproduction machine, 24" x 36" capacity	1
Triangles, 16", 30°/60°	2
Triangles, 16", 45°/45°	2
Tables, ordinary, 30" x 48"	2

THE following list of equipment for drawing, planning, and sketching for instruction in the junior-high grades is compiled from several suggested lists. It is designed for a class of 15 students.

JUNIOR-HIGH DRAWING

Boards, drawing, 18" x 24"	15
Brushes, drawing board	15
Instruments, complete sets	7
Instruments, partial sets, including dividers, pencil compasses	15
Curves, French, assorted	8
Scale, hardwood, ivory edge, 12"	15
Triangle, 30°/60°, 8"	15
Triangle, 45°, 6"	15
T-square, 24", amber edge	15
Protractor, 6"	15
Erasing shields	15
Tables, planning, 36" x 60", height 27"	8
Stools, drawing, 24"	15

THIS list of tools and equipment for instruction in drafting is adapted from several lists.

INSTRUMENTS FOR EACH STUDENT

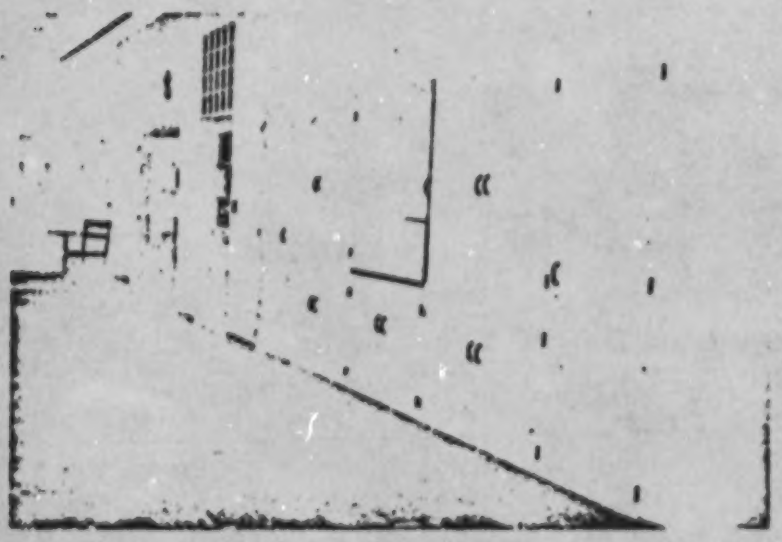
Triangle, 30°/60°, 8" and 45°, 8"
Duster, bench
Scale, architect's, 12"
T-square, 24"
Board, drawing, 18" x 24"
Instrument set

DRAWING-ROOM INSTRUMENTS

Lettering set
Parallel rules
Drafting machine
Reproduction machine
Wall-type drafting unit, board 48" x 96"
Ellipse templates
Tool designer's template
Lead pointers
Mechanical lead holders
Eraser, electric
Proportional divider
Compass, beam
Compass, drop bow pen and pencil
Pen, contour
Pen set, technical
Knife set
Scale, engineer's, 12"
Calipers, inside and outside spring
Caliper, vernier
Caliper, micrometer
Combination printer and developer, 47" throat
Curves, French, mixed sizes
Paper cutter, 15"
Blueprint frame 22" x 30"
Overhead projector

FURNITURE

Drafting table with board storage and stool for each student
Drawing table, instructor's
Bookcase
Storage case and filing cabinet
Sink, wall, 30" x 20" x 10"
Tracing table



The best-equipped drawing rooms also have provisions for storage of supplies and for protection of them when not in use. Here is a storage unit in the drafting room of the Muhlenberg Township High School, Laureldale, Pa. The unit contains space for boards, supplies, extra equipment and for files.

F. Power

1. General Rules -- Automotive Mechanics

a. The automotive laboratory should be kept clean.

b. No one should use the machines unless he has had proper instruction in their use.

c. Scuffling, playing, throwing, loud talking, and running is ABSOLUTELY FORBIDDEN.

d. The floor should be kept clean of all scrap materials, parts, and tools.

e. All injuries, even a small scratch or cut, must be reported to the teacher immediately.

f. If automotive parts, hoses, jacks, extension cords, and other objects are carelessly left on the floor, they may cause a fall. These items should be kept out of walkways.

g. All students should be familiar with the location and use of all fire fighting equipment in the shop.

h. All students must be familiar with the emergency exits.

i. It is most important that proper ventilation be maintained in the automotive laboratory at all times and especially when running gasoline engines.

j. Be sure there is adequate light where you are working.

k. When working under a car, protect your eyes.

l. It is dangerous to talk to an operator of a machine which is running.

m. The power must be OFF when oiling or cleaning any type of equipment.

n. Observe good housekeeping at all times. Wipe up grease, water, oil, etc., immediately, or cover with sawdust or sand.

o. Be careful with sharp pointed oil cans. Do not leave them where someone may fall on them.

p. Oily and greasy rags should be kept in sealed metal containers.

q. Check the safety relief valve on the compressor every day.

r. Report all injuries, however slight, to the teacher.

s. Wear eye protection at all times when working in the lab.

t. Do not wear loose clothing and roll sleeves up above elbows when operating machines.

u. Store gasoline in safety cans designed for that purpose.

v. Use only approved cleaning fluids not gasoline for parts cleaning.

w. Use a face shield when using compressed air.

x. When working under a car on a lift, a hard hat should be worn.

2. Specific Automotive Safety Rules

a. Hydraulic Floor Jacks

1. Do not use a jack if there is any doubt about its safe operation.

2. Do not work under any car or object supported by a jack alone. Use axle stands for safety.

3. When the floor jacks are not being used, they should be placed out of the way where no one will fall over them.

4. Never lift or lower a car or object if someone is working underneath.

b. Lifting Heavy Objects

1. When lifting any object, be sure to grasp it firmly so it will not slip.

2. Lift with your legs and not your back.

3. Keep your back as nearly vertical as possible while lifting.

4. Use assistance for lifting a heavy object. Lifting objects which are too heavy can cause serious injury.

c. Tires

1. Inflate tires only to recommended pressure.

2. If gauge appears to be faulty, notify the teacher/employer.

3. Avoid looking directly at a tire or valve while inflating. A blast of air could blind you.

4. Stand as far to one side as possible when putting air in tires and protect face with fender in case the tire blows.

d. Fires

1. Gasoline should NEVER be used as a cleaning agent.

2. Keep all oily and gasoline soaked rags in a fireproof container.

3. Learn the location and use of all fire extinguishers.

4. When starting or operating an automotive engine, a fire extinguisher must be readily accessible.

3. Small Engines

a. Pull the spark plug wire off a spark plug before attempting a repair.

b. Do not work around fan blade while the engine is running.

c. Never check the motor oil with the engine running.

d. Never run an engine in a closed room.

e. Never drain gas around a hot engine or in a closed area.

f. You must always wear safety glasses when operating on an engine or working with any solvents.

g. Never let the starter cord snap back.

h. Be sure the engine is properly mounted before attempting to operate it.

i. Never pull a spark plug wire off while the engine is running.

j. Never start a lawn mower on stones or dirt.

4. Chain Hoist

a. Stand clear of any weight being lifted with a chain hoist.

b. The hoist or lifting device should never be overloaded, know the capacity of the hoist and follow it.

c. Working under an engine or car held up by a hoist is forbidden.

d. After lifting, block the car and take the weight off of the hoist.

e. Lift straight up. Do not pull the chain to one side. This may cause the load to shift.

f. Do not play with the chain hoist.

g. When through using the chain hoist, put it away.

5. Grinder and Buffer

a. Goggles or a face shield must be worn when grinding or buffing. Keep the glass clean.

b. The tool rest on the grinder should be 1/8 inches from the grinding wheel. Excessive clearance permits work to jam between the wheel and tool rest.

c. Be sure that the tool rest is secure and tight.

d. Always turn the grinder off before leaving it.

e. Excessive pressure against the grinding wheel causes overheating of the work and may cause breakage of the wheel.

f. Be careful of fingers when using the buffer or wire wheel.

g. Keep the grinder running at full motor speed. Avoid slowing the wheel by use of excessive pressure.

h. Small pieces of metal must not be ground on a grinding wheel.

i. When starting the grinder, do not stand in line with the wheel.

j. Stand to one side while grinding.

k. Allow no one to watch who is not wearing goggles or a face shield.

l. Grinding wheels that do not run true must not be used.

m. The work should always be held below center and to the front of the buffing wheel.

G. Electricity/Electronics

a. General Safety Rules

Everyone seems to know that electrical energy can be dangerous and even fatal to those who do not understand and practice the simple rules of safety. Strange as it may seem, there are more fatal accidents involving electricity by well-trained technicians who either through over-confidence or carelessness violate the basic rules of personal safety. The first rule of personal safety is always -- THINK FIRST -- and this rule applies to all industrial workers as well as electrical workers. Develop good habits of workmanship. Learn to use tools correctly and safely. Always study the job at hand and think through your procedures, your methods, and the application of tools, instruments, and machines. Never permit yourself to be distracted from your work and never distract another worker engaged in hazardous work. Don't be a clown!

1. After the power supply is turned off, work on the electrical circuits as if the power is on -- remember that "unloaded guns kill".

2. When a fuse burns out check the circuit for cause before replacing fuse.

3. Safety devices are designed to protect you; however, sometimes they don't function. - Beware!

4. Always replace fuses with one of the proper rating for the circuit.

5. Know the location of the first aid kit in your shop.

6. Insist that every cut or bruise receive medical attention regardless of how minor it seems to be.

7. An accident caused by lack of knowledge is inexcusable.

8. The National Electrical Code and the Local Regulations must be followed for safe and approved wiring.

9. Type of current should be determined prior to repairing or replacing wires.

10. Do not use any equipment which produces a slight shock when operated.

11. Never wear metal rings, bracelets, or chains while working in the electrical trades.

12. Never check circuits with fingers to see if they are "Hot".

13. Never guess, always know exactly what you are about to do.

14. Standing in water or on a damp floor is hazardous even when turning an electrical switch on or off.

15. Don't take a chance and touch one wire thinking it is the ground wire.

16. Do not touch or move broken wires lying on the ground. Report it to the police department.

17. Always have another person with you while you work on high voltage.

18. On all occasions study the hazards of electricity and acquire skill in preventing accidents.

19. Loose wires and unknown switches should not be connected or operated without knowledge of their purpose.

20. Always wear rubber-soled shoes, stand on a rubber mat or dry board without nails, and work as if the wires are "hot" when repairing or installing electrical equipment in a damp basement.

21. Always work one side of a circuit at a time. This minimizes the danger of closing a circuit with your body.

22. All action around electricity should be carefully considered and physical movement be unhurried.

23. After the electrical equipment and circuits have been checked against the wiring diagram the final connection may be made at the source of power.

24. Never turn on the power until you notified all workers in the area.

25. A very dry stick is used to move an unknown fallen wire or a person lying on a live wire.

26. Electrical appliances or fixtures should never be operated from the bathtub or sink.

27. First aid to people receiving electrical shock should be administered only if you have read the American Red Cross book or the National Electric Light Association pamphlet.

28. Proper grounding of all equipment is a must for prevention of accidents and fatal injuries.

29. When the source of power is turned off the same person who directed it to be turned off should always turn it on.

30. Always make sure the power is off before working on electrical equipment or circuits by testing with a glow tube tester.

b. Specific Safety Rules in the Electrical Fields

1. Vacuum tubes get very hot when in use; you should wait for them to cool before removing from the chassis.

2. Handle all components with care - five and ten watt resistors get very hot and may give you a third degree burn.

3. Capacitors retain a charge which sometimes causes burns or a fatal shock.

4. Soldering irons and guns should be placed or stored after use in such a manner that someone does not accidentally burn himself.

5. Never shake hot solder off when de-soldering joints because you or your neighbor may be hit in the eyes, face, body, or clothes.

6. File metal corners and sharp edges of chassis and panels.

7. Always select the proper tool for the specific job.

8. Safety glasses should be worn when grinding, chipping, or working with hot metals which may splatter.

9. While working with acids, etchants, and finishing fluids protective gloves and clothing should be worn.

10. An orderly work bench will prevent accidents and injuries.

11. Never work alone.

12. Don't talk to anyone while you work or talk to someone working because it may distract them and cause an accident.

13. Speedy work habits may be hazardous.

14. Replace all two wire input plugs with three wire plugs.

15. Only repair or adjust electrical equipment which is part of your job.

16. Never disconnect ground wires leading from electrical fixtures.

17. All electrical power tools should be properly grounded.

18. All electrical cords should be checked for breaks in the insulation.

19. Inspect droplights to see that the socket, plug, and guard are in good condition.

20. Battery power lights of not more than twelve volts should be used in wet or damp places.

21. De-energize electrical circuits before working on wires or components.

22. Always lock or tag de-energized circuits so others will not turn on the power supply.

23. A "drip loop" should always be used at the point of entrance of the service wires.

24. Don't carry plugged electrical power tools with your finger on the trigger switch.

25. Soldering irons should not be heated until red hot.

26. Do not use powder driven fastners that will go completely through the material and cause injury on the other side.

27. Always point the powder driven fastner toward the work or floor.

28. Only load the powder driven fastner gun when it will be used immediately.

29. Always determine the amount of current that a particular gauge of wire may carry safely.

c. Preventative Maintenance

1. A complete first aid kit (unlocked) should be in the room at all times.

2. A pupil should never be left alone to work in a lab.

3. There should be adequate lighting and ventilation in the labs.

4. A non-skid abrasive paint should be applied to the floor areas around machines.

5. There shall be "panic bar" type handles on all exit doors.

6. There shall be proper grounding of all power driven equipment

7. Provision should be made for orderly storage of text books and coats.

8. The room must have a phone in it.

9. Proper type of fire extinguishers should be set-up and easy to reach in case of emergency.

Safety Electricity Shop

Students/Instructor

1. I will not operate any testing equipment unless I have received proper instruction from the instructor. *** _____

2. Circuits hooked up to Signal Generator—Power Supplies will be checked before final hook-up. *** _____

3. All electric appliances e.g., toasters, air conditioners, coffee pots will be disconnected from a voltage source when being worked on _____

4. Radios, recordplayers, stereos will be grounded _____

5. All capacitors on radios will be discharged to prevent any shock _____

6. Soldering runs will be placed in the proper soldering tray _____

7. Keep the area clean and tools in their proper place _____

8. No horseplay will be tolerated _____

9. No equipment is to be used without previous instruction _____

10. No machinery is to be used without asking the instructor permission first _____

11. All injuries will be reported to the school nurse immediately _____

    a. When wiring switches and outlets fuses will be removed from the circuit panel. _____

    b. All circuits will be tested with a voltage tester prior to wiring any electrical device. _____

    c. Current is always shut off before making wire changes in any circuit. _____

    d. When working on appliances or motors the circuit will be completely de-energized. _____

    e. All wire cuttings and armored cable will be discarded at the end of the work period. _____

    f. All worn out materials will be replaced with U.L. approved materials. _____

g. All rings, watches, and other metal objects removed before working on circuits.

h. All hand tools will be covered with an insulating type of material.

i. Outlet boxes will be marked as to the exact voltage they carry.

j. Working area will be covered with a rubber insulating material.

Depending upon student level (Course he or she is taking) they will receive instruction on all of the below listed equipment.

Signal Generators-Power Supply	
Oscilloscopes	Low Voltage Power Supply
VRVM'S	Pocket Meters
TRVM'S	Tube Tester

Power Supply - Low Voltage

1. Obtain manual and receive instructors approval prior to use.

2. Output

AC high	14.4 volts	DC high	17.6 volts
AC low	7.8 volts	DC low	8.3 volts

3. Complete safety is assured by isolation of the output circuits of this power supply.

4. There is no connection to the power line.

5. The voltage available is sufficiently low so no shock hazard exists.

6. A six (6) ampere circuit breaker eliminates the possibility of damaging the power supply by overloading even if the output terminals are shorted.

7. Additional safety feature of this unit is the reset button that holds the circuit breaker open.

Oscilloscope

1. Obtain Oscilloscope Manual.

2. Unit is grounded. NO output voltage from this piece of equipment.

Signal Generator-Power Supply

1. Obtain the Manual.

2. Each student will receive instruction prior to use.

3. Power supply is variable from 0 - 250 volts DC.

4. The power supply is not regulated, this reduces the possibility of harm to the student due to shock. The student is taught to respect the output voltage, however, this respect should not make him afraid to work with the power supply.

The tube tester and the VTVM have circuit breakers built in to prevent any shock to the student or anyone operating the testing equipment.

Other testing meters work of two (2) 1 1/2 volt D dry cell batteries.

H. Crafts Technology

1. General Safety Requirements:

a. ATTITUDE: Develop a good attitude toward safety. Work safely and carefully. A safe attitude will protect you and others.

b. SECURE APPROVAL: Secure approval from your instructor for all work you plan to do. He/she will decide if the work can be done and will be able to suggest the best, easiest and safest way to do it.

c. CLOTHING: Dress properly for your work. Remove coats. Tuck in ties. Roll up sleeves. Wear a shop apron.

d. EYE PROTECTION: Wear safety glasses when doing any operation that may endanger the eyes, such as using lacquer thinner. Be sure that there is adequate lighting for you to see what you are doing.

e. CLEAN HANDS: Keep the hands clean, free of grease, oil and ink.

f. CONSIDERATION OF OTHERS: Help others in your class and group. Be sure that you are working in a safe manner so as not to endanger someone. Caution other students if they are violating a safety rule.

g. TOOL SELECTION: Select the proper size and type of tool for your work. Be sure that they are sharp and in good condition. Tell your instructor if tools are broken, have loose handles, or need adjustments.

h. CARRYING TOOLS: Carry sharp and pointed tools pointing downward. Do not swing your arms or put them over your head when carrying them. Do not carry sharp tools in your pockets.

i. CLAMPING STOCK: Whenever possible, such as doing linoleum block printing, hold the work in a special holder.

j. USING TOOLS: Hold a tool in the correct position while using it. Make sure that you push the engraving tool for block printing away from you and other students. Be careful when guiding a cut that you do not cut your fingers.

k. WORKING SPEED: Do not rush through your work. Keep a steady, unhurried pace. This is essential for safety and will produce the best work.

l. FLOOR SAFETY: The floor around the paper cutter should be kept free of litter. Keep all materials out of the isles. Wipe up all spilled liquids immediately.

m. LIFTING: Lift heavy objects with your arms and leg muscles.

n. MATERIAL AND PROJECT STORAGE: Store your jobs that you are working on in the designated storage lockers. Do not leave materials out on the tables or on the floor. Paper and tools should be stored in designated places.

o. TABLE ORGANIZATION: Keep your materials for your job carefully organized on your table. Keep sharp pointed tools near the center of the table. Do not pile tools on top of each other. Do not let sharp pointed tools extend out over the edge of the table. Keep drawers and cabinet doors closed.

p. FIRE PROTECTION: Use flammable liquids only in approved areas. Close cans of thinners immediately. Be sure containers are properly labeled. Dispose of all combustible materials immediately or store them in an approved container. All flammable liquids should be stored in an approved, fire proof, metal storage cabinet.

2. Hand Tools

a. Use the right tool for the job to be performed.

b. Be sure that tools and hands are clean and free of grease or oil before using.

c. Cutting tools should be sharp when using them. Dull tools cause accidents because of the greater force required to use them.

d. Sharp pointed and sharp edge tools should be carried pointing downward.

e. When you hand tools to others, give them with the handle first.

f. Always report damaged tools to the instructor. Damaged tools can cause injuries.

g. Tools should always be wiped free of grease or dirt after use and they should be returned to the proper storage location.

h. Be careful not to drop heavy tools on the floor.

i. Be sure to cut away from you when cutting silk screen film or doing linoleum block printing.

3. Crafts Machines

a. General Requirements:

1. Always be sure to get the instructor's approval to operate a machine.

2. Wear appropriate clothing. Remove coats. Tuck in ties. Roll up sleeves. Wear a shop apron.

3. Be wide awake and alert. Never operate a machine while you are over-tired or sick.

4. Think through the operation before performing it. Know how you are going to do it, and what the machine will do.

5. Make all necessary adjustments before turning on the machine. Some adjustments on certain machines will require the approval of the instructor.

6. Never remove or adjust a safety guard without the permission of the instructor.

7. Use approved safety devices. Some machines may require the use of a special jig or fixture.

8. Keep the machines clear of tools, paper and project materials. Keep the floor around the machines free of scraps and litter.

9. Allow the machine to reach their full operating speed before starting to use them.

10. Feed the machine carefully and only as fast as the machine will take the material.

11. Maintain the MARGIN OF SAFETY specified for the machine.

12. If a machine is out of adjustment or not working properly, shut it off immediately and inform the teacher.

13. Make sure that you are the one to control the machine. Start and stop the machine yourself. If someone is helping you, be sure that they understand what you are doing and what is expected of them and how to do it.

14. Do not allow your attention to be distracted while operating a machine. Be sure that you do not distract the attention of others who are operating machines.

15. Stay clear of other machine operators. When finished with your machine, shut it off. Never leave a machine running or unattended. Do not crowd around while waiting to use a machine.

16. Make sure that all machines are well guarded.

b. Specific Requirements:

1. Be careful when cutting glass with a glass cutter or bottle cutter so as not to cut yourself.

2. Always wear eye protection when cutting glass.

3. Be careful not to cut yourself when removing plastic castings with a sharp knife.

4. Be careful not to cut your fingers when using sharp metal for jewelry, such as, copper, aluminum, silver or brass.

5. Be careful not to spill hot, melted wax on you when making candles.

6. Always wear eye protection when using hot, melted wax.

7. Do not use water to extinguish a wax fire.

8. Be careful not to break a glass mold when pouring hot, melted wax into it.

9. Never breathe the fumes of airplane dope (glue).

10. Always wear eye protection when using a soldering copper.

11. Always wear protective clothing when soldering.

12. Do not point the can at anyone while using hair spray, paint, varnish, lacquer or clear acrylic spray.

13. Always wear eye protection when working with acids.

14. Always wear protective clothing when working with acids.

15. Do not burn your fingers on the kiln or copper enameling kiln.

16. Do not hit fingers with hammer when pounding nails for string art.

17. Be careful in plant selection not to select poisonous ones for plant dying and leaf art, such as, poison ivy, poison oak, poison sumac, yew, aleander, hemlock, laurel, rhododendrum, wild cherry, beech, poinsettia, lily-of-the-valley, horse chestnut, and wild cherry.

18. Make sure that all lamps are electrically wired correctly.

19. Wear protective clothing when using stain.

4. Finishing Operations

a. Eye protection must be worn while using cleaners and solvents.

b. Dispose of all wiping rags in a closed, metal container.

c. Do not use lacquer thinner in the presence of an open flame while doing silk screen work.

d. Cleaning fluids and solvents must be stored in a fire proof, metal cabinet.

e. Wash hands immediately after using cleaners and solvents.

5. Preventative Maintenance

1. A complete first aid kit (unlocked) should be in the room at all times.

2. Never leave an injured pupil alone in the room.

3. A pupil should never work alone in the room.

4. There shall be adequate lighting and ventilation in the room.

5. The floor shall be smooth and unwaxed.

6. Non-skid abrasive paint should be applied to the floor areas around machines.

7. There shall be "panic bar" type handles on the exit doors.

8. There shall be proper grounding of power driven equipment.

9. There shall be a wash-up sink and other work sinks in the room.

10. There shall be hot and cold water, paper towels and suitable hand cleaners in the room.

11. Provision should be made for orderly storage of books and coats.

12. Heavy or breakable items should be stored on the floor under shelves.

13. Pupils are not to use a chair or box to reach top shelves.

14. The room must have a phone in it.

15. Proper type of fire extinguishers should be used in the room.

IX. Handicapped

The school population now includes more handicapped students than it had in the past. Some students used to go to special schools, while others may have been cared for in other than school situations. Some handicapped students were just not able to participate in some programs simply because special arrangements had not been made for them to do so.

In recent years laws have been passed, requiring that the local school systems provide education for students with various handicaps, students who in the past had not been educated in the general public school, or for whom full programs were not available in the public schools.

Provisions must be made to accommodate people with various handicaps so they can operate machinery, equipment and tools safely.

This might mean that certain equipment would have to be adapted, or that arrangements would have to be made to allow some students to reach certain equipment.

It is possible that additional staff might have to be present when some students are in the room, or that the number of students in the area be limited.

With handicaps being so many and so varied, one must make arrangements for those with whom the staff come in contact.

Special funding might be available from state and federal sources, to help improve the offerings in the various areas.

Some national civic associations are interested in providing financial, or material help to school systems for some special projects. Local chapters should be contacted to find out what is available.

SAFETY FOR DEVELOPMENTALLY DISABLED AND HANDICAPPED STUDENTS

A. Civil Rights Mandate

The Rehabilitation Act of 1973, Section 504 was initially enacted into law to protect the civil rights of all handicapped Americans. The implementation regulations and enforcement provision did not become law until June 1977. Now, however, it provides greater opportunities for physically or mentally handicapped individuals.

The basic requirements of the law are summed up in the following section:

General Provision Against Discrimination (Section 84.4)

Any program or activity which receives federal financial assistance (1) may not exclude qualified handicapped persons from aids, benefits or services; (2) must provide equal opportunity to participate or benefit; (3) must provide services as effective as those provided to the nonhandicapped, and (4) may not provide different or separate services except when necessary to provide equally effective benefits.

Services need not be identical to those provided to the nonhandicapped, but must be the equivalent to them and must afford an equal opportunity to achieve results in the most integrated setting appropriate to the persons "needs."

Mainstreaming is the result generally associated with Section 504. It puts students in a "least restrictive environment," usually a regular classroom or lab situation. When one or two special needs students are mainstreamed into a regular class, special safety considerations and/or precautions must be taken by the teacher. Such situations will have to be adapted to the individual needs of the student and the program.

B. General Statement

The responsibility for safe working conditions in a school laboratory is the prime concern of the teacher and all the students who work in the facility. With this in mind, the instructor of industrial arts subjects should make a special effort to teach safety to the disadvantaged and handicapped students enrolled in his or her program. Many special students such as these will need added instruction in safety with emphasis on personal responsibility to themselves and others with whom they work. Initially, instruction should be given in a classroom setting for short periods using an abundance of visual

aids to explain proper safety procedures. Small group demonstrations can also be very effective while using the actual machines and tools. Individual instruction should follow the small group demonstrations before the students actually use the equipment in the laboratory. In addition, safety reviews should be repeated at intervals to help reinforce safety procedures.

Industrial arts teachers must be alert at all times during the working sessions for unsafe conditions and actions by the special students, and should be ready to take remedial steps if needed. Other sections of this manual list specific safety procedures and lessons that the teacher should follow to instill safe working habits in the student with special needs.

C. Suggested Teaching Techniques

1. Be sure that eye protection is worn. Have the students remind each other that safety glasses must be worn.

2. Check out each student on the power tools that he or she is about to use. Review the safety rules from time to time with each student — especially after a vacation or prolonged absence of the student. Be sure to document the reoccurance of this instruction.

3. Medical records should be checked to determine if any special students are subject to seizures, fainting spells, etc. If the teacher finds someone who has one of these conditions, that individual should be given additional monitoring while using all equipment.

4. Make students aware of the potential dangers of cleaning agents, cutting fluids, solvents, thinners, lubricants, etc.

5. Remind students periodically of the importance of keeping work areas clean and free of hazardous objects.

6. Usually there is not a problem of horseplay by special students in a shop class unless they are encouraged by other students. The amount of horseplay will depend on the professional personnel and the rules established for the laboratory. If students are kept busy and supervised, horseplay for the special student is no major problem.

7. Isolation of a special student when rules of the laboratory are violated has been found to be one of the most effective methods of discipline. Keeping the student separated from the rest of the group should last no longer than one class period.

8. Special students have a tendency to wander about the laboratory area. They must understand that they have an area to which they are assigned and must stay there.

9. Testing of the special student's abilities should be done by continual observation by the teacher, and demonstration by the student. Evaluation should not be limited to tests requiring reading, writing, and comprehension.

10. The teacher should design jigs and fixtures that serve to promote a higher level of student success while using tools and machines.

11. Communication between teacher and student may be enhanced by using devices that improve reception and expression of information. Amplifying and magnifying stimuli, whether coming in or going out, are important considerations.

12. Individualize the program of instruction as much as possible to modify the instructional method to meet the needs of the student.

13. Plan to reserve a portion of your facility that can be made free from noise, physical stimuli, and visual stimuli. This may help those students who are easily distracted by them.

14. Minimize access barriers to sinks, tool cabinets, doorways, machines, workbenches, shelves, desks, etc.

15. Accept the child as he or she comes to you. Keep in mind that the student's success depends not only upon his or her own characteristics and abilities, but also upon the teacher's attitude and the quality of the learning environment.

16. Employ the aid of the special education resource people on your school staff. These people are specialists who can provide you with valuable information in dealing with the problems of the special needs students enrolled in your program.

17. Keep in mind, that special needs students respond very favorably to frequent verbal praise and reinforcement. A non-reading "hands-on" environment may provide some real positive feelings of success for them through this praise, and also by seeing their finished products.

18. Encourage heterogeneous grouping with the classroom. Placing the special student within a small group of students with various abilities will provide him with models for behaviour in a laboratory or other industrial-type facility.

X. Resources For Safety Instruction

Appendix A General Information Sources Regarding OSHA

Appendix B The Student and Safety In Industrial Arts

Appendix C Hazardous Conditions Report

Appendix D Accident Reporting/Student Accident Report

Appendix E Pennsylvania School Industrial Arts Safety Inspection Check List

Appendix F Selected Bibliography

Appendix G Connecticut Eye Safety Manual

Appendix H Pittsburgh Paint Color Coding

Appendix I Equipment Instruction Sheets and Evaluation

Appendix A

General Information Sources Regarding OSHA (Occupational Safety and Health Act)

NIOSH (National Institute for Occupational Safety and Health)

Regional Office:

1. DHEW - Region I
   Government Center (JFK Fed. Bldg.)
   Boston, Massachusetts 02203
   Tel: 617-223-6668/9

2. OSHA Regional Office
   U. S. Department of Labor
   Occupational Safety and Health Administration
   JFK Building, Room 184
   Boston, Massachusetts 02203
   Tel: 617-223-6712/3

3. Conn. - OSHA
   Connecticut Labor Dept.
   Occupational Safety and Health Division
   200 Folly Brook Boulevard
   Wethersfield, CT 06109
   Tel: 203-566-7184

American National Standards Institute (ANSI)
1430 Broadway
New York, New York 10018

National Fire Protection Association (NFPA)
470 Atlantic Avenue
Boston, Massachusetts 02210

National Safety Council
444 North Michigan Avenue
Chicago, Illinois 60611

Health and Safety Consultants
For a list of health and safety consultants write to:
American Industrial Hygiene Association
c/o William E. McCormick
Managing Director
475 Wolf Ledges
Akron, Ohio 44311

The University of Texas Health Science Center
P. O. Box 20186
Houston, Texas 77025
(713) 792-4300

The Johns Hopkins University
School of Hygiene & Public Health
615 North Wolfe Street
Baltimore, Maryland 21205
(301) 935-3720 or 3537

Department of Environmental Sciences
and Engineering
School of Public Health
University of North Carolina
Chapel Hill, North Carolina 27514
(919) 966-1023

Department of Environmental Health
University of Washington
Seattle, Washington 98195
(206) 543-6991

Department of Environmental Health
University of Cincinnati
College of Medicine
3223 Eden Avenue
Cincinnati, Ohio 45267
(513) 872-5701

Harvard University
School of Public Health
665 Huntington Avenue
Boston, Massachusetts 02115
(617) 732-1260

University of Minnesota
School of Public Health
420 Delaware Street, S.E.
Minneapolis, Minnesota 55455
(612) 373-8080

Department of Family & Community
Medicine
University of Arizona Health
Sciences Center
Tucson, Arizona 85724
(602) 882-6244

School of Public Health
University of Illinois at the
Medical Center
P. O. Box 6998
Chicago, Illinois 60680
(312) 996-7811

University of Utah
Medical Center
Room BC 106 DFCM
Salt Lake City, Utah 84132
(801) 581-8719

Mt. Sinai School of Medicine
1 Gustav Levy Place
New York, New York 10029
(212) 650-6174

Appendix B

The Student and Safety in Industrial Arts

_____School District
Industrial Arts Department
School:_____
Teacher:_____

To: _____
Parent or Guardian

_____ is enrolled in our industrial arts
(Name of Student)
program and will have the opportunity to use various tools and equipment. Appropriate instruction in the safe operation of these tools and equipment is given and close supervision is maintained at all times. Although every precaution is taken to prevent accidents, a certain risk is involved due to the nature of the experience, the age of the student, and the learning environment.

We are asking your cooperation in impressing upon your child, the importance of being careful. This we believe will back up the instruction that is given in school.

We welcome your visit to our school and the industrial arts department to see our program. These visits can be arranged by calling _____.

Thank you very much for your help and assistance in providing your child with the "real world" experience of industrial arts in a safe working environment. I have read the attached communication and I understand the type of program that _____ is enrolled in. I will
(Student Name)
stress the safety aspects of this program to my child. I encourage my child to participate fully in this industrial arts program.

_____ _____
(Signature of Parent or Guardian) Date

Phone _____ (Home) _____ (Work) _____

Please identify any health problems which may have a bearing on your child's participation in this class.

_____

I agree to observe all safety rules and procedures for safe operation and conduct in the school industrial arts shop and will wear approved eye protection at all times while in the laboratory in accordance with state law.

_____ _____
Signature of Student Date

Appendix C

Hazardous Conditions Report

This is a suggested method for reporting the hazard and directing action to see that the hazard is corrected or removed.

If a hazard exists, the operation should be "red tagged" and shut down until corrected. (NOTE: THIS FORM CAN BE USED TO REPORT A STUDENT WHO IS A HAZARD AS WELL AS A HAZARDOUS CONDITION IN THE LABORATORY).

Hazardous Conditions Report

DATE _____

TO: _____
(Building Administrator) (Position) (School)

Description and Location of Health or Safety Hazard:

_____

_____

_____

Suggested Solution:

_____

_____

_____

Teacher Signature _____

Distribution: Original - Building Administrator
1st Copy - Department Chairperson
2nd Copy - Teacher Reporting Hazard
3rd Copy - District Safety Officer

Action Taken:

_____

_____

By Whom: _____
(Signature)

Appendix D

Accident Reporting

Any accident that occurs during industrial arts activities and in the industrial arts shop must be reported. This applies to after school accidents as well as those during the school day. Any accident, even a slight cut, must be reported since this indicates corrective action that must be taken by the teacher, administrator, or both.

A form for the reporting of these accidents can be adapted from the one on the following page. This report should be completed in triplicate; one for the principal, one for the school nurse, and one for the teacher's permanent file.

Accident Reporting and Analysis

1. Require students to report all accidents to the teacher, regardless of nature or severity.

2. Keep a record of all industrial arts accidents resulting in injury to students, regardless of nature or severity.

3. Analyze all accident reports for the purpose of aiding in the prevention of other accidents.

4. Use your school district's printed or duplicated form to record the details of accidents and forward to the appropriate personnel.

Industrial Arts Department

Student Accident Report

TO BE COMPLETED BY INSTRUCTOR

Student Name _____ Grade _____

Location of Accident _____ Time ____A.M.___/___P.M.
(Lab Area)

Date of Accident _____

Description of Injury _____

_____

Location of Instructor when Accident Occurred: _____

Description of How Accident Happened: _____

_____

Indicate Equipment, Machinery, or Tools Involved: _____

Describe unsafe practices, if any, contributing to accident: _____

_____

Suggestions for prevention of similar accident: _____

_____

Witnesses to Accident: 1. _____

2. _____

Instructor's Signature _____ Date _____

Student's Signature _____ Date _____

NOTE: One Copy to be filed with Department Chairperson

Appendix E

PENNSYLVANIA SCHOOL INDUSTRIAL ARTS SAFETY INSPECTION CHECK LIST

Prepared by the Pennsylvania Department of Education and the Industrial Arts Association of Pennsylvania

School _____ Laboratory _____ Date _____

Instructor _____ Inspection Team _____

_____

PURPOSE

A safe environment is an essential part of the industrial arts safety education program. The safe environment will exist only if hazards are discovered and corrected through regular and frequent inspections by school personnel-administrators, safety coordinators, teachers and students. Safety inspections are to determine if everything is satisfactory.

A safety inspection checklist for industrial education is an objective tool for helping improve working conditions in the area where used. Using a safety check list for the inspection has some advantages over other methods of safety inspection. This list is intended to accomplish the following:

1. Inform, educate and remind people of what to look at.
2. Train personnel to be observant and aware of their environment.
3. Provide a source of feedback information to teachers and administrators. This allows them to determine the effectiveness of their safety program and training.
4. Provide a record of safety items and safety activity.

The Pennsylvania School Industrial Arts Safety Inspection Check List is recommended for all industrial arts laboratory inspections.

INSTRUCTIONS FOR USE

1. A safety inspection team should complete the check list for each industrial arts laboratory. (The building principal should be a member of the team.)
2. The inspection team may arrange for additional assistance from outside agencies for the regular safety inspections.
3. As a minimum, safety inspections should be made at the beginning of every school term or semester. More frequent inspections may be advisable.
4. Inspections should be planned in advance, preferably for times when students will be using the facility.
5. The current inspection report should be compared with previous reports and records to determine progress. The report should be studied in terms of accident situations so that special attention can be given to these conditions and locations which are accident producers.
6. In all cases where unsatisfactory responses are indicated it is important that corrective actions be noted and copies forwarded to the proper authorities.
7. Each unsafe condition should be corrected as soon as possible in accordance with accepted local procedures.
8. A conference of the inspection team and the teacher should be held shortly following the inspection.

CHECKING PROCEDURE

Draw a circle around the appropriate letters, using the following code. Respond to all items:

S — Satisfactory (needs no attention)

U — Unsatisfactory (needs immediate attention)

NA — Not applicable

Recommendations should be made in all cases where a "U" is circled. Space is provided at the end of the form for such comments. Designate the items covered by the recommendations, using the section letter and number applicable (e.g. B—2).

Original—Teacher 1st Copy—Principal 2nd Copy—Central File

A. SCHOOL ADMINISTRATION

1. The school principal and school safety officer visit all laboratories to check for hazardous conditions and to make provisions for corrections. . . . . S U NA
2. The school principal requires that standardized written reports on hazardous conditions be submitted and distributed to the proper individuals to assure corrective action . . . . . S U NA
3. A written procedure has been established for reporting defective equipment immediately to assure prompt repair . . . . . S U NA
4. The school principal keeps records of all inspections and these records are readily available for reference . . . . . S U NA
5. The school district has defined "an accident" and has available employee and student accident reporting forms which fulfill the state statistical requirements . . . . . S U NA
6. All accidents are promptly reported and analyzed. Immediate steps are undertaken to correct causes of accidents, and copies of all reports are kept in a school file until it is determined they are not longer necessary. . . . S U NA
7. The school has readily available all necessary information in order to reach parents or guardians in case of emergency. . . . . S U NA
8. The school has an effective standardized district safety policy . . . . . S U NA
9. The school has an effective policy and procedure to follow in case of accident . . . . . S U NA
10. The school has a policy and procedure for the administration of first aid . . . . . S U NA
11. The instructor is notified of all student disabilities (physical and mental) . . . . . S U NA
12. The instructor has direct communication with the school nurse and outside telephone lines available . . . . . S U NA
13. First aid personnel or nurse is available at all times. . . . . S U NA
14. The school principal accepts the responsibility for keeping class sizes appropriate for activities, student age, facility size, and the number of work stations available . . . . . S U NA
15. The school principal is aware of his responsibility and liability in regard to students' protection . . . . . S U NA
16. The school principal requires that the shop areas be maintained and cleaned, and provided with the same custodial services available to other general education programs. . . . . S U NA
17. The school principal will make sure that an industrial arts certified instructor is in attendance when student work takes place . . . . . S U NA
18. A policy exists for dealing with the removal of students who consistently violate safety regulations. . . . . S U NA

B. INSTRUCTOR

1. Industrial arts teacher supervision is provided at all times when classes are in session . . . . . S U NA
2. The instructor continuously inspects his facility to discover needed repairs and corrections. . . . . S U NA
3. The instructor utilizes an inspection checklist when making formal inspections and maintains file copies. . . . . S U NA
4. The instructor reports all hazardous conditions to the proper administrator . . . . . S U NA
5. The instructor keeps records of all inspections and has copies of inspection reports readily available for reference . . . . . S U NA
6. The instructor keeps records of all maintenance problems and the disposition of requests for corrections. . . . . S U NA
7. The instructor keeps records of all accidents, and analyzes them immediately for corrective measures . . . . . S U NA
8. The instructor keeps records of all safety instruction and evaluation. . . . . S U NA
9. The instructor selects student activities, keeping in mind the maturation level and ability of the students involved . . . . . S U NA
10. Instructor-owned tools are not used by students unless a district policy has been established to cover their use, and the school principal has been informed. . . . . S U NA
11. The instructor makes sure that students wear protective equipment when needed. . . . . S U NA
12. The instructor is responsible to see that personal protective equipment has been sterilized . . . . . S U NA
13. Instruction is reinforced by continuous proper example through deeds and actions of the instructor, such as wearing protective equipment in all situations deemed necessary. . . . . S U NA
14. The instructor is knowledgeable in the use of the various fire extinguishers in his facility. . . S U NA
15. When classes are not in session, the instructor makes sure that all main power switches are in the "off" position . . . . . S U NA
16. The instructor makes sure that all machines are off and tagged when they are being cleaned or adjusted . . . . . S U NA
17. A system for handling hot materials has been established. . . . . S U NA

Original—Teacher 1st Copy—Principal 2nd Copy—Central File

18. Routine preventative maintenance is practiced to assure against breakdown of equipment and safety protection devices. . . . . S U NA

C. INSTRUCTION

1. The student's sense of responsibility is promoted, developed and periodically evaluated . S U NA
2. Students receive instruction in the use of all tools and equipment they are expected to operate . . . . . S U NA
3. Students are tested and permission is granted before machines are operated. . . . . S U NA
4. Ground rules are established and enforced for safe, efficient shop operation. . . . . S U NA
5. Students are instructed and alerted to possible hazardous operations and are monitored in these activities . . . . . S U NA
6. "Horseplay" and practical jokes are dangerous and are not tolerated . . . . . S U NA
7. Proper instruction and warning are given in the use and handling of toxics, caustics and volatile materials. . . . . S U NA
8. In order to provide continuous safety instruction, questions on safety are included in all phases of the instructional program. . . . . S U NA
9. Students are instructed in the proper methods of handling and lifting materials. . . . . S U NA
10. Students are given the responsibility to see that they and other students are clear of machines when turning them on, never to leave a machine in a running position, or stop one with their hands or a piece of material. . . S U NA
11. Students are instructed to stay clear of others operating machines and, if necessary to approach an operator, to do so in such a manner not to annoy or alarm him/her . . . . . S U NA
12. All work undertaken is approved through some established method before proceeding . . S U NA
13. Materials being worked are secured when the operation being conducted so demands . . . . . S U NA
14. A class personnel organization is used including a student safety engineer . . . . . S U NA
15. Safety bulletin boards, posters and student reports are part of the total safety program . . S U NA
16. Students are instructed as to how to report hazards and fires . . . . . S U NA

D. PERSONNEL PROTECTION

1. In compliance with Pennsylvania Law, eye protection devices will be worn and appropriate signs posted. . . . . S U NA
2. Eye-wash baths and showers are available when using caustic materials . . . . . S U NA
3. After use, eye-protective devices are cleaned and returned to properly designed storage racks. . . . . S U NA
4. In all areas needing special body-protective clothing, such clothing is provided and used. (Examples: aprons, shoes, gloves) . . . . . S U NA
5. In all areas needing respiration devices and noise suppression devices, such devices are provided and used . . . . . S U NA
6. Students are cautioned on the danger of loose clothing, jewelry, ties, long hair, etc. (Regulations in regard to their dangers are enforced.) S U NA
7. All injuries are reported to the instructor for immediate attention. . . . . S U NA

E. GENERAL FACILITY

1. One instructor has the overall responsibility for each major shop facility. . . . . S U NA
2. Each major shop facility can be locked separately . . . . . S U NA
3. Provision has been made for keeping inappropriate garments and other materials out of activity areas . . . . . S U NA
4. Good housekeeping standards are observed. . . S U NA
5. The student educational cleanup program is backed up daily with complete custodial services . . . . . S U NA
6. Waste (shavings, sawdust, paint, and oil rags) is collected daily and disposed of by the custodian. . . . . S U NA
7. Floors are maintained in a condition conducive to safe practices with nonskid surfaces provided around machines. . . . . S U NA
8. Designated safety zone areas are provided around all dangerous areas of work . . . . . S U NA
9. Aisles are clear of protruding materials . . . . S U NA
10. Room furniture and equipment are arranged for optimum safety . . . . . S U NA
11. Nonglare lighting is provided for all work areas according to State Board of Health regulation . . . . . S U NA
12. Stairways within existing laboratories have safe tread and rise with unobstructed access and with approved railings. . . . . S U NA
13. Railings and treads are color coded. . . . . S U NA
14. Two widely separate marked exits are available from each major laboratory area . . . . . S U NA
15. Facilities are light, pleasant, clean and conducive to good instruction. . . . . S U NA
16. Machine operation regulations and safety procedures are posted conspicuously near areas of operation . . . . . S U NA

Original—Teacher 1st Copy—Principal 2nd Copy—Central File

17. Parts of machines and equipment needing special attention or caution are painted brightly with correct color code . . . . . S U NA

18. Machine and work stations are located in relationship to the amount of supervision required. . . . . S U NA

19. Machine location has been determined by needed operator space requirements and process compatibility . . . . . S U NA

20. Health hazards were considered in plant design to minimize injuries from excess heat, noise, fire and fume conditions. . . . . S U NA

F. STORAGE

1. Storage racks and shelves are designed and constructed to meet storage requirements . . . S U NA

2. Materials are stored in a safe manner . . . . . S U NA

3. Students and instructors are protected from protruding materials and sharp edges. . . . . S U NA

4. All flammable and combustible liquids, toxics and caustics are stored securely in proper containers, identified by name and degree of hazard. . . . . S U NA

5. Fire-approved storage cabinets are provided for all flammable and combustible liquids . . . S U NA

6. Provision has been made for a fire-approved bulk storage area. (Refer to local fire marshall) . . . . . S U NA

G. ELECTRICAL

1. All power wiring is installed and maintained in accordance with national electric code and-

   (a) switches are enclosed . . . . . S U NA

   (b) circuits are identified . . . . . S U NA

   (c) all power cords are of proper length as determined by gauge and load . . . . . S U NA

   (d) power supplies are provided with overload protection . . . . . S U NA

   (e) lockouts are provided. . . . . S U NA

2. All outlets and machines are grounded. . . . . S U NA

3. All extension cords are three-wire with proper connections . . . . . S U NA

4. All portable power tools are provided with three-prong plugs, except those which are double insulated . . . . . S U NA

5. Readily accessible individual "off" and "on" controls are installed on all machines as well as in the room power-control panel. . . . . S U NA

6. On machines where injury might result if motors were to restart after major power shutoff, provision is made to prevent such restarting. (Magnetic switches.) . . . . . S U NA

7. A master-control "Panic Stop System" is available and conveniently located in each laboratory to shut off power . . . . . S U NA

8. Each laboratory area has its own master-control switch and power panel located for easy access . . . . . S U NA

9. Laboratory power panels have clearly identified individual power switches for each machine. . . . . S U NA

10. Extension cords are not used for permanent installation. . . . . S U NA

11. All hand-held portable power tools are equipped with "dead man" controls only . . . . . S U NA

12. Regulator, stands and pilot lights are provided for all electrical soldering irons. . . . . S U NA

13. All electrical apparatus in areas of concentrated vapors are vapor proof. . . . . S U NA

H. EQUIPMENT

1. Safety instructions for the use of each machine is posted . . . . . S U NA

2. Machines are in safe operating condition at all times. . . . . S U NA

3. "Out-of-order" signs are secured to machines not in working order and power panel switch is in "off" position . . . . . S U NA

4. All machines are securely fastened in place according to good industrial practice. . . . . U NA

5. Machines and equipment are provided with guards meeting industrial standards and guards are in proper position for safe machine operation. . . . . S U NA

   Items requiring special consideration are: . . . .

   (a) squaring shears finger guard. . . . . S U NA

   (b) foot treadle stops on squaring shears. . S U NA

   (c) jointer knife guards-left and right . . . . S U NA

   (d) abrasive wheel safety eye shields. . . . . S U NA

   (e) abrasive wheel tool rests . . . . . S U NA

   (f) abrasive wheel guards. . . . . S U NA

   (g) table saw guard including anti-kickback . . . . . S U NA

   (h) radial saw guard . . . . . S U NA

   (i) radial saw forward stop and positive saw return . . . . . S U NA

   (j) radial saw anti-kickback device. . . . . S U NA

   (k) machine belt and pulley guards . . . . . S U NA

   (l) air compressor belt guards. . . . . S U NA

(m) compressed air is not used for cleaning purposes until it has been reduced to less than 30 p.s.i. . . . . S U NA

(n) compressed air is not used for cleaning purposes where possibility of eye injury exists . . . . . S U NA

6. Equipment control switches are readily accessible to the operator while he/she is in a normal operating position . . . . . S U NA

7. A positive "off" position switch is located on each machine . . . . . S U NA

8. Proper tools and materials are available for machine cleaning . . . . . S U NA

9. Hand-tool equipment is stored with sharp cutting edges protected . . . . . S U NA

10. Hand tools are properly maintained and kept sharp . . . . . S U NA

11. Bench tops are in keeping with the activities planned (Example: electrical bench tops are made of non-conductive materials) . . . . . S U NA

12. Properly designed and constructed auto stands and roll blocks are used. (A sufficient supply is available to meet the needs of the power mechanics areas.) . . . . . S U NA

13. Engine stands are properly designed and constructed . . . . . S U NA

14. All hoists and A-frames are properly constructed, designed for the job undertaken, labeled as to capacity and fitted with a safety block . . . . . S U NA

I. FIRE

1. When available, only U.L. approved equipment will be used . . . . . S U NA

2. A sufficient number of proper fire extinguishers (periodically inspected, dated, and recharged) is readily accessible in all activity areas . . . . . S U NA

3. A wool fire blanket is available for clothing fire. (Special caution should be taken with polyester clothing.) . . . . . S U NA

4. Area behind fire extinguisher is color coded . . S U NA

5. Extinguishers are hung at approved heights . . . S U NA

6. Adequate exit doors and open aisles are available for prompt evacuation . . . . . S U NA

7. Fire-approved (U.L.—FM) storage and waste containers are readily accessible, used and emptied daily . . . . . S U NA

8. Parts (solvent) wash tanks are fire fused . . . . . S U NA

9. Finish and spray room doors swing out and cannot be locked from the inside . . . . . S U NA

10. Filters in spray booths are replaced regularly . S U NA

J. WELDING

1. Proper protective clothing is worn when needed . . . . . S U NA

2. Goggles with the proper lenses are used when torch welding . . . . . S U NA

3. An arc-welding helmet with correct lenses is used when electric welding (Min. Shade #12-MIG & TIG) (Min. Shade #10-STD. ARC) . . . S U NA

4. Observers use acceptable protection . . . . . S U NA

5. Welding is done only in areas free of combustible materials . . . . . S U NA

6. Cylinders are secured up-right, clear of passageways, and stored in ventilated areas . . . . . S U NA

7. Extra cylinders are properly stored, meeting regulations of the Pennsylvania Department of Labor and Industry . . . . . S U NA

8. Gas pipelines have been installed and are maintained according to code . . . . . S U NA

9. Pipelines are checked each year by persons knowledgeable with code requirements . . . . . S U NA

10. Piped welding systems will have back pressure valves in both lines and conveniently located shutoff valves which will not be quick opening S U NA

11. Torches and regulators are clean, well maintained, and in good operating condition . . . . . S U NA

12. Hoses are maintained in good condition . . . . . S U NA

13. Only spark lighters are used to light torches . . S U NA

14. Anti-fire flashbacks are installed where required in all hoses and lines . . . . . S U NA

15. The welding area is located in such a manner that an arc cannot be struck on (gas) cylinders, gas lines or water lines . . . . . S U NA

16. Reflective screens are provided and used to protect others from arc flashes and burns . . . . S U NA

17. When items to be welded will not fit into screened area, all persons near area will be provided proper protective equipment . . . . . S U NA

18. Arc welding is done in dry areas only . . . . . S U NA

19. The electrode holder is maintained and stored in good condition to eliminate possible accidental arcs . . . . . S U NA

20. Proper ventilation is provided . . . . . S U NA

K. GAS

1. Gas-operated equipment is ignited from an automatic ignition system or pilot light . . . . . S U NA

2. The main supply cutoff valve is identified, is readily accessible, and is located outside possible heat or fire areas . . . . . S U NA

3. Gas equipment is provided with a shutoff valve and a safety system. (Example: spark ignition, gas pressure regulator, safety gas check valve, etc.) . . . . . S U NA

Original—Teacher 1st Copy—Principal 2nd Copy—Central File

4. Only nonflammable insulating materials have been installed adjacent to gas appliances .... S U NA

5. Warning signs are posted when hot metals are poured ..... S U NA

6. Property designed and constructed equipment is used for handling molten metal when casting. ..... S U NA

RECOMMENDATIONS

Recommendations should be made in all cases where a "U" is circled. Space is provided at the end of the form for such comments. Designate the items covered by the recommendations, using the section letter and number applicable (e.g. B—2).

School _____ Laboratory _____ Date _____

Instructor _____ Inspected by _____

_____

Section Letter and Number

Original—Teacher 1st Copy—Principal 2nd Copy—Central File

Appendix F

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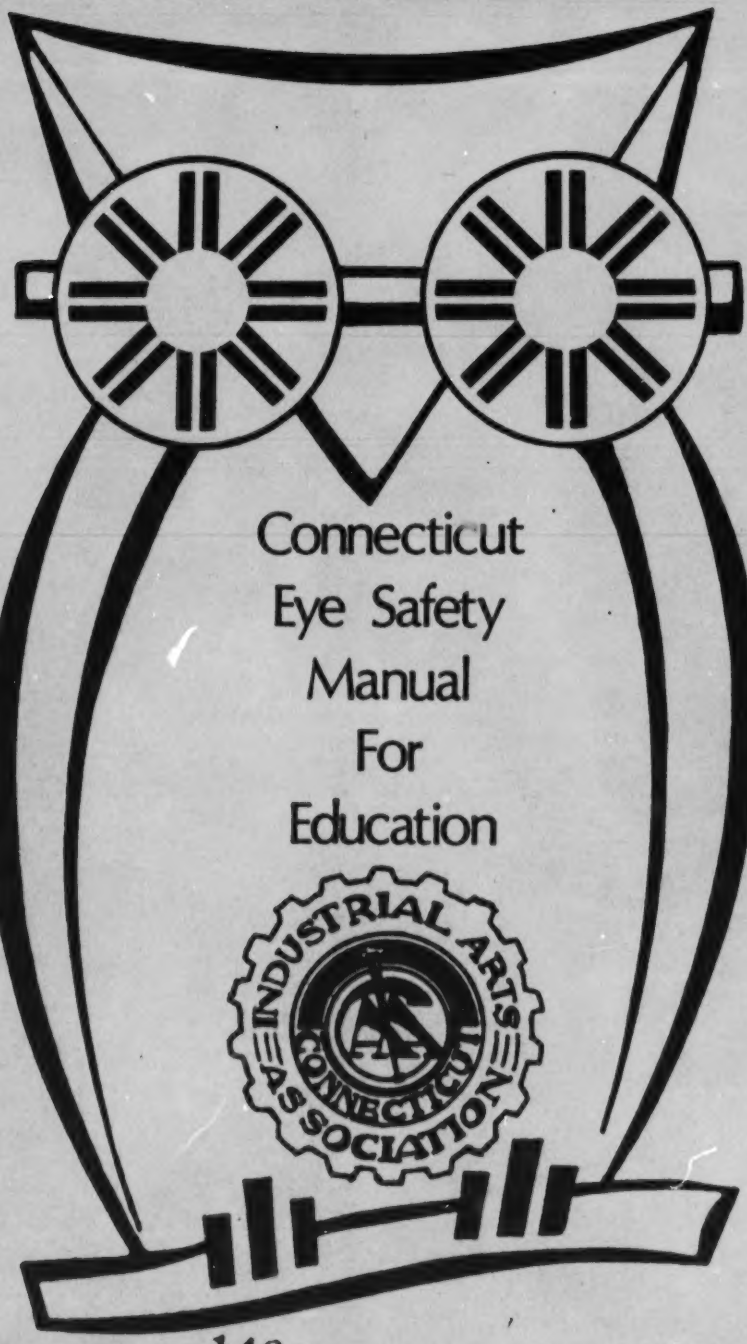
Connecticut
Eye Safety
Manual
For
Education
INDUSTRIAL ARTS
CONNECTICUT
ASSOCIATION

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CONNECTICUT
EYE SAFETY MANUAL
FOR
EDUCATION

Co-Sponsored By

Connecticut Industrial Arts Association

and

Connecticut Society to Prevent Blindness, Inc.

March, 1979

SOURCES OF INFORMATION AND TEACHING AIDS

Bureau of Elementary and Secondary Education
State Department of Education
P.O. Box 2219
Hartford, Connecticut 06115
(203) 566-2117

Bureau of Vocational-Technical Schools
State Department of Education
P.O. Box 2219
Hartford, Connecticut 06115
(203) 566-3664

Connecticut Industrial Arts Association
c/o Industrial Arts Consultant
Bureau of Vocational Services
State Department of Education
P.O. Box 2219
Hartford Connecticut 06115
(203) 566-2630

Connecticut Society to Prevent Blindness
P.O. Box 20/20, 24 Wall Street
Madison, Connecticut 06443
(203) 245-5700 or 1-800-842-0692

Industrial Arts Consultant
Bureau of Vocational Services
State Department of Education
P.O. Box 2219
Hartford, Connecticut 06115
(203) 566-2630

National Safety Council
School and College Department
444 North Michigan Avenue
Chicago, Illinois 60611
(312) 527-4800

National Society to Prevent Blindness
Industrial Service Department
79 Madison Avenue
New York, New York 10016
(212) 648-3505

Over 1,000 eye accidents occur in school and industry daily in this country. More alarming is that 90% of these mishaps are preventable. As educators, one of your challenges is to teach the value of good vision and the means of protecting it.

Development of a positive attitude toward good eye safety now will help students later adjust more easily to an industrial setting that requires complete eye safety measures.

This manual, a revision of its 1971 predecessor, seeks to help the shop or laboratory instructor develop a sound eye safety program using current methods and equipment. It is the result of the diligent work of a committee of concerned educators, state officials, safety experts, and others concerned with eye safety who were willing to devote their time in the interest of sight conservation. We hope that it will be used just as enthusiastically.

David K. Rowland
Executive Director
Connecticut Society to
Prevent Blindness

Werner R. Priess
Professional Improvement
Chairman
Connecticut Industrial Arts
Association

David M. Mordavsky
Industrial Arts Consultant
State Department of Education

The following group has donated its time and resources to this first revision of the Connecticut Eye Safety Manual for Education. Without their contributions, this manual would have been incomplete.

David M. Mordavsky - Industrial Arts Consultant, Bureau of Vocational Services, State Department of Education and Revision Committee Chairman, Hartford

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Werner R. Friess - Professional Improvement Chairman, Connecticut Industrial Arts Association, Westport

Clarence M. Green - Associate Commissioner/Director, Division of Vocational Education, State Department of Education, Hartford

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Peter Messer - Industrial Arts Instructor, Schaghticoke Middle School New Milford

James E. O'Neil - Director of Industrial Service, National Society to Prevent Blindness, New York, New York

Steven Rimer - Graphic Arts Instructor, Westhill High School, Stamford

David K. Rowland - Executive Director, Connecticut Society to Prevent Blindness, Madison

Mark R. Shedd - Commissioner of Education, State Department of Education, Hartford

Leonard Taddei - Supervisor of Industrial Arts, Board of Education New Haven

Errol J. Terrell - Chief, Bureau of Vocational Services, State Department of Education, Hartford

Wisconsin Society to Prevent Blindness, Industrial and School Eye Safety Committee, Milwaukee, Wisconsin

Wisconsin Department of Public Instruction, Madison, Wisconsin

Implementation of Eye Protection Programs in Connecticut Schools

Since January 9, 1967, eye safety programs as mandated by Section 10-21-A-1-3 of the Connecticut Statutes have been a part of the instructional responsibilities of each elementary and secondary educational entity in Connecticut (See Page 16). Each staff member has the personal resonsibility to assure that those persons in his area, whether visitors, students, faculty, or custodians, wear the proper eye protection devices.

It is the legal responsibility of the Administration of each educational institution to assure compliance with this law. The development of a total safety program should be delegated to a competent professional staff person who should be directly responsible to the Superintendent. In addition, regular orientation meetings should be held at least annually with the entire staff to fully explain the program and assign responsibilities for its implementation. The Administration should emphasize that compliance with and enforcement of the statutes are requirements of the instructional process.

The School Safety Officer and an administrator should conduct an inspection at least monthly to determine compliance, and deficiencies should be corrected immediately. Repeated violations should be corrected by administrative action.

Faculty members should fully analyze the eye hazards involved in activities for which they are responsible and explain to students the need for the type of eye protection specified in the work. For eye hazards not covered in this guideline, the hazard must be analyzed by the School Safety Officer in conjunction with the Administration to determine the appropriate eye protection required under the American National Standard Institute Code Z87.1.

All eye injuries should be promptly treated by authorized medical personnel. Eye injuries should be reported as prescribed by current instructions for reporting accidents.

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GENERAL INFORMATION

ALL EYE AND FACE PROTECTIVE EQUIPMENT MUST MEET THE CURRENT STANDARDS OF THE "AMERICAN NATIONAL STANDARD PRACTICE FOR OCCUPATIONAL AND EDUCATIONAL EYE AND FACE PROTECTION, STANDARD Z87.1". PRIOR TO DELIVERY, AND IN BID SPECIFICATIONS, SUPPLIERS MUST CERTIFY THAT DEVICES TO BE DELIVERED MEET THESE STANDARDS. **(See Section IV, Page 13.)**

I. Advantages of Safety Glasses Over Street Eyewear

A. Safety lenses have a minimum 3 mm. thickness, while street eyewear lenses are generally far less.
B. Safety lenses are manufactured and treated to give greater strength to increase their resistance to impact.
C. Safety lenses are fitted into frames from the front to prevent the lens from being pushed into the eyes in the event of impact.
D. The frames of safety glasses are made of special materials for greater strength and flame resistance.
E. Safety glasses equipped with full side shields afford greater protection.
F. All components of the safety glasses must meet ANSI standards, not just the lenses.

II. Personal Eyewear

A. Those desiring to wear their own approved ANSI quality safety prescription glasses may do so providing the glasses are equipped with side shields meeting the ANSI Z87.1 Standard.
B. Those wearing non-approved personal eyewear must wear cover goggles meeting the ANSI Z87.1 Standard.
C. Food and Drug Administration "impact resistant" lenses do not meet the ANSI Standard.

III. Contact Lenses

An advisory committee on Industrial Eye Health and Safety of the National Society to Prevent Blindness has issued the following position statement on the use of contact lenses in eye-hazardous work areas. This position statement is applicable to education as well as industry.

"Because of increased risk to the eyes, the National Society to Prevent Blindness strongly advises that the use of contact lenses of any type by industrial employees while at work should be prohibited, except in rare cases. The National Society recommends that any exceptions be verified in writing to the employer by the physician or optometrist who sanctions such use in a specific industrial environment. Contact lenses do not provide eye protection in the industrial sense; their use without eye and/or face protection devices of industrial quality should not be permitted."

IV. Phototropic Lenses

Phototropic lenses change depth of tint when exposed to varying degrees of ultra-violet radiation, i.e., daytime light conditions. Presently available phototropic lenses do not fully comply with ANSI Z87.1 indoor light transmission requirements, nor should they be worn anywhere that hazardous ultra-violet or infra-red radiation could be encountered. No variable or fixed-tint lenses should be worn indoors unless called for by the nature of particular tasks, or when prescribed for individuals by ophthalmic specialists.

V. Maintenance of Eye Protection Devices

Protectors are a personal item and should be for the individual and exclusive use of the person to whom they are issued. *If circumstances require reissue, the protectors shall be throughly cleaned and disinfected periodically (a minimum of once a week) as described below.*

Pitted or scratched lenses may reduce vision and seriously reduce protection. Lenses that are pitted or scratched should be replaced when, in the judgment of the safety supervisor or other qualified person, the eye safety device may no longer afford optimum protection.

A. Cleaning

1. Thoroughly clean all surfaces with soap or suitable detergent, and warm water. Carefully rinse all traces of soap or detergent. Completely immerse the protector for ten minutes in a solution of modified phenol, hypochlorite, or quaternary ammonium compounds, in a strength specified by the manufacturer, at a room temperature of 68 degrees F. Remove protector from solution and suspend in a clean place for air drying at room temperature, or with heated air. Do not rinse because this will remove the residual effect.
2. Ultra-violet disinfecting equipment may be utilized in conjunction with the washing procedure above, when such equipment can be demonstrated to provide comparable disinfection.
3. Spray-type disinfecting solutions and bactericides may be utilized when such pressurized spray solutions can be demonstrated to provide comparable disinfection with the immersion procedure outlined above.
4. Protectors showing need for extensive cleaning should be disassembled to the extent possible without tools, prior to the washing and disinfection procedure. Replace defective parts with new ones. (Z87.1)

B. Storage

The dry parts or items should be placed in clean, dustproof containers to protect them. (Z87.1)

ILLUSTRATIONS OF TYPICAL EYE PROTECTION DEVICES

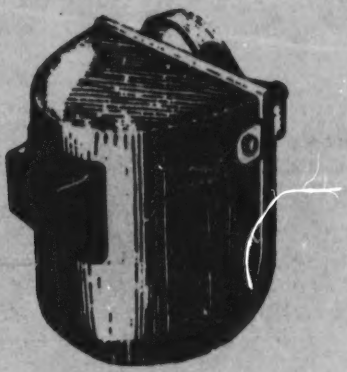
1. **Safety Spectacles with full side shields and comfort cable temples.**

2. **Chemical Goggles (with hooded vents)—for chemical splash protection and impact of flying particles.**

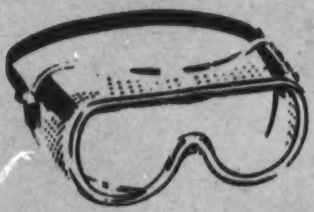
3. **Plastic Face Shield—.040 thickness. Not a primary protection device. Shall be used in conjunction with safety spectacles.**

4. **Welding Goggles—for excessive glare, welding spatter, burning or cutting operations. Special plates or lenses protect against the dangerous infra-red and ultra-violet rays. Not a primary protection device. Shall be used in conjunction with safety spectacles.**

5. **Welding Helmet**—for arc welding. This device offers protection for weld spatter, sparks, harmful infra-red and ultra-violet radiations. Not a primary protection device. Shall be used in conjunction with safety spectacles.



6. Shop Goggle with perforated frame - for protection against flying Particles.



7. Visitors' Eye Protective Device with side sheilds. Use limited *only* to visitors.

Eye Protection Areas

I. Physical and Biological Science Laboratories and classrooms

A. Eye protection devices shall be worn in grade K-12 science teaching areas (i.e., laboratories, classrooms and demonstration areas), where the following conditions exist:

1. Chemicals are stored or handled.
2. Any other activity or operation involving mechanical or manual work in any area that is potentially hazardous to the eye.

B. Operations that are particularly hazardous such as those which may involve implosions, explosions, and infra-red or ultra-violet radiation warrant special eye protection, such as face shields and/or tinted or polarized lenses.

C. Where demonstration equipment is shielded or isolated from students. However, all participants are required to use approved safety eyewear.

D. Persons wearing ordinary street glasses or contact lenses shall wear chemical goggles over their street eyewear. *Face shields alone plus ordinary street eyewear offer insufficient protection.* In chemical situations contact lenses are especially conducive to serious eye damage since they trap any kind of splashes behind the lenses resulting in direct eye contact and almost immediate eye damage.

E. Visitors shall wear visitors' eye protective devices with side shields or chemical goggles where required.

OPERATION OR MACHINE	EYE HAZARD	EYE PROTECTION DEVICES
Chemicals	Splashing and/or spilling	Chemical goggles

II. Vocational, Career and Fine Arts Education

The following table indicates the required eye protection devices for specific shop activities and their particular hazards:

OPERATION OR MACHINE	EYE HAZARD	EYE PROTECTION DEVICES
Welding		
Welding, electric arc	Welding flash; flying sparks, flux; sputtering welds, air bubble explosions	Welding helmet over safety spectacles equipped with attached side shields

OPERATION OR MACHINE	EYE HAZARD	EYE PROTECTION DEVICES
Welding (cont.)		
Gas welding, cutting, burning and metalizing	Flying sparks and metal	Welding goggles over safety spectacles equipped with attached side shields
Chipping welds	Flying chips, slag	Safety spectacles equipped with attached side shields
Other work	Flying chips, sparks	Safety spectacles equipped with attached side shields.
Foundry Work		
Chipping and grinding castings, core and mold making	Flying chips, sand and parting compound	Shop goggles or safety spectacles equipped with attached side shields
Heating and pouring metal	Splashing and sputtering molten metal	Shop goggles or safety spectacles equipped with attached side shields and face shield
General Metals		
(All metal work including plumbing and pipe fitting) Annealing, bending and shaping metals, drilling, forging, grinding, heat treating, metal spinning, riveting, sawing metals,	Flying chips, chunks, projectiles, lubricants, lint, buffing compounds, sparks, abrasives, rivets, sputtering solder, flux, fluids	Shop goggles or safety spectacles equipped with attached side shields or chemical goggles (for severe exposure add face shield)

OPERATION OR MACHINE	EYE HAZARD	EYE PROTECTION DEVICES
General Metals (cont.)		
snipping metals, soldering, tinning copper		
Pickling of metals, handling of acids, caustics, cleaning operations, plating, etching	Splashing acid, caustic and cleaning fluids	Chemical goggles (for severe exposure add face shield)
Construction (Carpentry, Woodworking, Masonry)		
All operations	Flying chips, nails and stock, kickback, glue chips dusts and splashes	Shop goggles or safety spectacles equipped with attached side shields (for severe exposure add face shield)
Commercial Art		
Spray painting and other work	Sprays	Chemical goggles
Commercial Food		
Cooking	Flying hot grease	Chemical goggles
Graphic Arts		
Melting lead or wax, use of chemicals, cutting and stitching	Chemical and metal splatter, flying dust, flying objects	Chemical goggles

OPERATION OR MACHINE	EYE HAZARD	EYE PROTECTION DEVICES
Ceramics Kiln firing, enamel mixing, glass fritting, potters wheel	Flying clay, dust, fluids, air bubble explosions	Shop goggles or safety spectacles equipped with attached side shields (for severe exposure add face shield)
Enameling Enameling, kiln firing	Air bubble explosions, dust	Safety spectacles equipped with attached side shields (for severe exposure add face shield)
Jewelry Work Silver soldering, chasing and smelting	Sputtering metal, flux, flying chips	Chemical or shop goggles
Leather Carving Carving, stamping, scuffing	Flying chips, dust	Shop goggles or safety spectacles equipped with attached side shields
Mosaic Tile Work Cutting, grinding	Flying chips, dust	

OPERATION OR MACHINE	EYE HAZARD	EYE PROTECTION DEVICES
Plastics Area Buffing, carving, drilling, forming, sanding, sawing, shaping Extruding, heating, mixing, pouring, and fiberglassing	Flying chips, dust Splashing and spilling	Shop goggles or safety spectacles equipped with attached side shields Chemical goggles
Electricity/Electronics Drilling, boring, turning, punching, soldering, winding, tube handling, stripping, grinding and other work	Flying metal and chips, glass, wire, spattering	Shop goggles or safety spectacles equipped with attached side shields (when working on TV picture tubes-add face shield)
Auto-Power Mechanics Welding, electronic arc	Welding flash, flying sparks	Welding helmet over safety spectacles equipped with attached side shields

OPERATION OR MACHINE	EYE HAZARD	EYE PROTECTION DEVICES
Auto-Power Mechanics (cont.)		
Gas welding, cutting and burning	Flying sparks and metal	Welding goggles over safety spectacles equipped with attached side shields
Chiseling, drilling, grinding, sanding, milling, shaping	Flying chips, sparks	Shop goggles or safety spectacles equipped with attached side shields
Greasing, spray painting, steam and solvent cleaning	Grease, hot steam, mists, splashing materials	Chemical goggles
Machine Shop		
Grinding, chipping, filing and scraping, drilling, turning, milling, shaping, sawing, cutting	Flying objects, sparks, splashes	Shop goggles or safety spectacles equipped with attached side shields
Home Economics		
Cooking	Flying hot grease	Chemical goggles
Visitors	Variety of exposures	Visitors' eye protective device with attached side shields or chemical goggles where required

III. Maintenance and Custodial

Maintenance and custodial activities expose the eyes to a variety of hazards. Flying objects, splashes or corrosive liquids and dusts are among the most frequent causes of eye injury.

Many maintenance and custodial activities are similar to typical shop and laboratory practices and the recommemded protective equipment for those operations shall be used.

When eye hazardous maintenance and custodial activities are conducted in areas where passersby may be exposed, the hazard area shall be marked and barricaded to warn those passersby of the danger.

Visitors to maintenance shops or eye hazardous custodial activities shall wear visitors' eye protective devices with side shields or chemical goggles where required.

IV. American National Standards Institute

The American National Standards Institute (ANSI) is a non-profit organization which coordinates the voluntary development and maintenance of several thousand national consensus standards utilized by business and industry, governmental agencies, educational institutions and others.

The Z87.1 Standard for eye and face protective devices referred to in this eye safety manual, and referenced in federal (OSHA) safety health regulations was developed under the aegis of ANSI.

American National Standard Institute
(A.N.S.I.)
1430 Broadway
New York, New York 10018

OTHER RECOMMENDATIONS

1. Lessons on the subject of eye safety should be planned for each grade level and every area. These lessons should involve at least as much preparation as any other material presented in the program. After this instruction, all students should know their responsibilities for wearing eye saftey equipment.

2. When evaluating the present eye safety equipment to maintain a satisfactory program, these considerations are important:
   a. Do lenses meet the requirements of the ANSI Z87.1 Standard and subsequent revisions?
   b. Are lenses clean, clear and free of scratches?
   c. Is the present equipment the best type for the hazard involved?

3. When purchasing safety eyewear, all bidders should be informed that they must meet the following criteria:
   a. *Request to bid* text should clearly specify that "only devices which meet all requirements of the ANSI Z87.1 Standard" are to be bid upon.
   b. *Request to bid* text for "Visitors Specs" should be listed listed separately, noting that "temporary-use devices need not comply with the ANSI Z87.1 Standard."
   c. *Request to bid* text should stipulate that "all successful bidders will be required to certify on their business letterhead or by other appropriate means, that all eye and face protective devices to be delivered under their particular purchase order(s) will . . . with the exception of temporary-use "visitors specs" . . . meet all requirements of the American National Standard Practice for Occupational and Educational Eye and Face Protection, Z87.1."

4. Other purchasing considerations are as follows:
   a. Cable temples hold eyewear in place better than spatula-type temples, especially in face-down work positions.
   b. Plastic lenses require a special lens cleaning tissue to prevent scratching. For a thorough cleaning job, mild soap, warm rinsing, and air drying are recommended.
   c. Cover goggles exposed to chemicals should have Neoprene headbands which resist deterioration.
5. When eyewear is not in use, it is wise to provide for designed storage cabinets to store all safety devices or individual protective cases or boxes lined with soft material to avoid scratching. Stained, spattered, greasy, or even scratched eyewear will not afford good protection.

6. There is a decided difference between "impact resistant" prescription glass lenses and safety lenses. Industrial quality safety lenses have a trademark on the upper part of the glass lenses as required by ANSI Z87.1. Non-occupational safety lenses for street wear not

be marked. This indicates that industrial quality safety lenses meet the requirements of ANSI Z87.1, but the unmarked lenses do not.

7. The following is a guide for the selection of the proper shade numbers of filter lenses or plates used in welding. Shades more dense than those shown for various operations may be selected to suit the individual's needs.

Operation	Suggested Shade Number
Shielded Metal-Arc Welding, up to 5/32 (4mm) electrodes	10
Shielded Metal-Arc Welding,up to 3/16 to 1/4 (4.8 to 6.4mm) electrodes	12
Shielded Metal-Arc Welding, over 1/4 (6.4mm) electrodes	14
Gas Metal-Arc Welding (Nonferrous)	11
Gas Metal-Arc Welding (ferrous)	12
Gas Tungsten Welding	12
Atomic Hydrogen Welding	12
Carbon Arc Welding	14
Torch Soldering	2
Torch Brazing	3 or 4
Light Cutting, up to 1 in. (25mm)	3 or 4
Medium Cutting, 1 to 6 in. (25 to 150mm)	4 or 5
Heavy Cutting, over 6 in. (150mm)	5or6
Gas Welding (Light), up to 1/8 in. (3.2)	4 or 5
Gas Welding (Medium), 1/8 to 1/2 in. (3.2 to 12.7mm)	5 or 6
Gas Welding (Heavy), over 1/2 in. (12.7mm)	6 or 8

The choice of a filter shade may be made on the basis of visual acuity and may therefore vary widely from one individual to another, particularly under different current densities, materials, and welding process. However, the degree of protection from radiant energy afforded by the filter plate or lens when chosen to allow visual acuity will still remain in excess of the needs of eye filter protection. Filter plate shades as low as shade 8 have proven suitably radiation-absorbent for protection from the arc welding processes.

Note: In gas welding or oxygen cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the operation (spectrum).

(Excerpted with permission from the ANSI Z87.1 Standard for safety eyewear.)

REGULATIONS CONCERNING EYE PROTECTIVE DEVICES AS AUTHORIZED BY SECTION 214a OF THE CONNECTICUT GENERAL STATUTES

The regulations of Connecticut state agencies are amended by added sections 10-214a-1 to 10-214a-3, inclusive as follows:

Section 10-214a-1. *By whom, when and where eye protective devices shall be worn; definitions.* Any person who is working, teaching, observing, supervising, assisting in or engaging in any work, activity or study in a public or private elementary or secondary school laboratory of workshop where the process used tends to damage the eyes or where protective devices can reduce the risk of injury to the eyes concomitant with such activity shall wear an eye protective device of industrial quality in the manner in which such device was intended to be worn. For the purpose of sections 10-214a-1 to 10-214a-3, inclusive, "workshop" and "laboratory" shall include any room or area used to teach or practice industrial arts, vocational and technical education, science, arts and crafts, or any similar skill, activity or subject, The following list of sources of danger to the eyes and the type of protection required to be worn in each case is exemplary, not exclusive:

SOURCE OF DANGER TO THE EYES	TYPE OF PROTECTION REQUIRED
(a) Caustic or explosive chemicals	Clear goggles, splash proof
(b) Explosives, solids or gases	Clear goggles
(c) Dust producing operations	Clear goggles, splash proof
(d) Electric arc welding	Welding helmet
(e) Oxy-acetyline welding	Colored goggles or welding helmet
(f) Hot liquids and gases	Clear goggles, splash proof
(g) Hot solids	Clear or colored goggles, or spectacles
(h) Molten metals	Clear or colored goggles
(i) Heat treatment or tempering of metals	Clear or colored goggles
(j) Glare operations	Colored spectacles or goggles, or welding helmet
(k) Shaping of solid materials chipping, cutting, grinding, milling, sawing, stamping	Clear goggles or spectacles

(l) Repairing or servicing of vehicles when hazard is forseeable	Clear goggles or spectacles
(m) Spraying and dusting	Clear goggles, splash proof
(n) Other similar activity being conducted in the instructional program which risks damage to the eyes	Proper eye protective device

Section 10-214a-2. *Minimum standards for the design, construction and quality of eye protective devices used in schools.* Any eye protective device used in such school workshops or laboratories shall be designed and constructed to resist impact, provide protection against the particular hazard for which it is intended, fit snugly without interfering with the movements of the user and be durable, cleanable, and capable of frequent disinfection by the method prescribed for such device by the school medical adviser. All materials used in such eye protective devices shall be mechanically strong and lightweight, non-irritating to perspiring skin and capable of withstanding washing in detergents and warm water, rinsing to remove all traces of detergent and disinfection by methods prescribed by the school medical advisor without visible deterioration or discoloration. Metals used in such devices shall be inherently corrosion resistant. Plastics so used shall be non-flammable and shall not absorb more than five percent of their weight in water.

Section 10-214a-3. *Responsibilities of public and private elementary and secondary school governing bodies.* The governing board or body of each public and private elementary and secondary school in the state shall require the use of appropriate eye protective devices in each laboratory and workshop by any person in such areas during any activity risking damage to the eyes. Such boards shall enforce such rules and the regulations in sections 10-214a-1 to 10-214a-3, inclusive shall provide safety instructions in eye safety practices and the use of eye safety devices appropriate to the activity engaged in, and shall post warnings and instructions in laboratories and workshops which include the list of hazards and protection required set forth in section 10-214a-1. Such boards shall make and enforce rules for the maintenance of all eye protective devices in clean, safe condition and shall replace any such protector which becomes irritating to the skin. *Purpose:* To direct the school administrators in the kinds, construction, times and uses of devices for eye protection of teachers and pupils in school laboratories and workshops.

First Aid For Eye Emergencies

Specks in the Eye

DO lift upper eyelid outward and down over the lower lid.
DO let tears wash out speck or particle.
DO —if it doesn't wash out—keep eye closed, bandage lightly and see a doctor.
DO NOT rub the eye.

Blows to the Eye

DO apply cold compresses immediately, for 15 minutes; again each hour as needed to reduce pain and swelling.
DO —in case of discoloration or "black eye," which could mean internal damage to the eye—see a doctor.

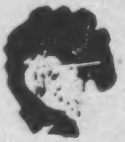
Cuts and Punctures of Eye or Eyelid

DO bandage lightly and see a doctor at once.
DO NOT wash out eye with water.
DO NOT try to remove an object stuck in the eye.

Chemical Burns

Eye damage from chemical burns may be extremely serious, as from alkalis or caustic acids; or less severe, as from chemical "irritants."

In all cases of eye contact with chemicals:



DO flood the eye with water immediately, continuously and gently, for at least 15 minutes. Hold head under faucet or pour water into the eye using any clean container. Keep eye open as widely as possible during flooding.
DO NOT use an eye cup.
DO NOT bandage the eye.
SPRAY CANS are an increasing source of chemical eye injury, compounded by the force of contact. Whether containing caustics or "irritants," they must be carefully used and kept away from children.

Appendix H

Color Coding For Marking Physical Hazards

A. Color identification

1. Red - Red shall be the basic color for the identification of:

   i. Fire protection equipment and apparatus

      a. Fire alarm boxes (pull boxes)

      b. Fire blanket boxes

      c. Fire buckets or pails

      d. Fire exit signs

      e. Fire extinguishers (if painting the extinguisher is impractical or undesirable, color should be used on the housing, wall, or support to identify the location)

      f. Fire hose locations (color should be used on the reel, supports, or housing but not on the hose)

      g. Fire hydrants (industrial)

      h. Fire pumps

      i. Fire sirens

      j. Post indicator valves for sprinkler system (it is suggested that if a traffic hazard is involved, the top should be colored red, and the barrel or post yellow and black stripes)

      k. Sprinkler piping (See ANSI - Standard Scheme for the Identification of Piping Systems, A13.1 - 1956)

   ii. Danger

      Safety cans or other portable containers of flammable liquids having a flashpoint at or below 80° F. table containers of flammable liquids (open cup tester), excluding shipping containers, shall be painted red with some additional clearly visible identification either in the form of a yellow band around the can or the name of the contents conspicuously stenciled or painted on the can in yellow. Red lights shall be provided at barricades

and at temporary obstructions, as specified in ANSI Safety Code for Building Construction, A10.2-1944. Danger signs shall be painted red.

iii. Stop

Emergency stop bars on hazardous machines such as rubber mills, wire blocks, flat work ironers, etc., shall be red. Stop Buttons or electrical switches which letters or other markings appear, used for emergency stopping of machinery shall be red.

2. Orange - Orange shall be used as the basic color for designating dangerous parts of machines or energized equipment which may cut, crush, shock, or otherwise injure and to emphasize such hazards when enclosure doors are open or when gear belt, or other guards around moving equipment are open or removed, exposing unguarded hazards.

3. Yellow - Yellow shall be the basic color for designating caution and for marking physical hazards such as: Striking against, stumbling, falling, tripping, and "caught in between." Solid yellow, yellow and black stripes, yellow and black checkers (or yellow with suitable contrasting background) should be used interchangeably, using the combination which will attract the most attention in the particular environment.

4. Green - Green shall be used as the basic color for designating "Safety" and the location of first aid equipment (other than fire-fighting equipment)

5. Blue - Blue shall be the basic color for designating caution, limited to warning against the starting, the use of, or the movement of equipment under repair or being worked upon.

6. Purple - Purple shall be the basic color for designating radiation hazards. "Radiation" as used in this subparagraph refers to radiation types such as X-ray, alpha, beta, gamma, neutron, proton, deuteron, and meson. Yellow should be used in combination with purple for markers such as tags, labels, signs, and floor markers.

7. Black, white, or combinations of black and white - Black, white, or a combination of these two, shall be the basic colors for the designation of traffic and housekeeping markings. Solid white, solid black, single color striping, alternate stripes of black and white, or black and white checkers should be used in accordance with local conditions.

B. Color specifications

Colors shall meet the tests specified in section 3, Color Definitions, of ANSI Z53. 1-1967, Safety Color Code for Marking Physical Hazards.

Appendix I

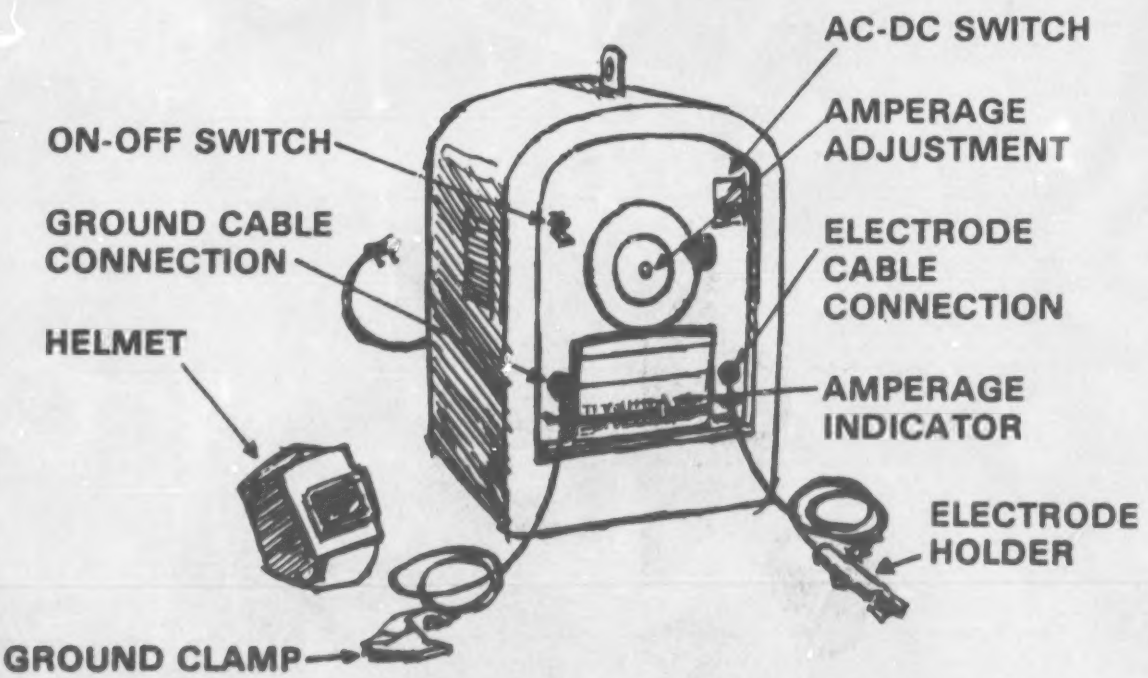
Equipment Instruction Sheets and Evaluation

The equipment instruction sheets that follow are designed to be used as an information sheet and a follow-up quiz. These sheets contain only basic information and safety rules. They should not be considered to be a complete safety instruction package.

Different manufacturers' equipment may require changes in the sheets. Additional material should be developed to fit individual needs and to supplement the information provided.

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. A welding helmet must be worn when welding.
6. Proper ventilation must be available.
7. Goggles must be worn when chipping slag.
8. Others in the area must be warned prior to striking an arc.
9. Gloves and proper clothing must be worn when welding.
10. Closed containers should not be welded without the instructor's permission.
11. Cables, clamps and electrode holder should be checked and working properly.
12. Screens to protect others must be in place before welding is started.



S

Arc Welder

Name _____

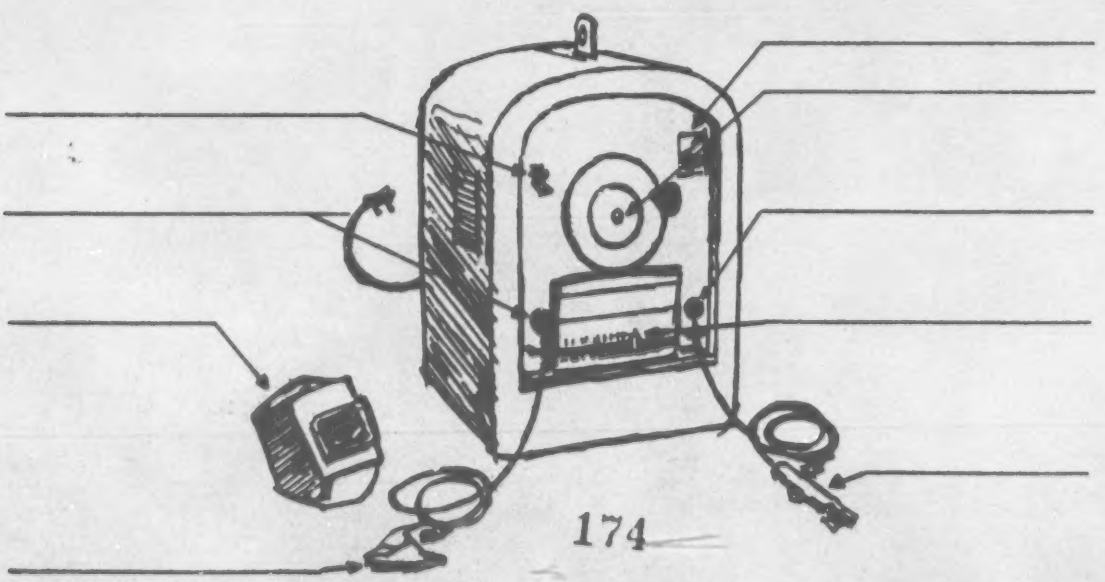
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. You should warn anyone nearby before you start to weld. T F
2. Goggles as well as a welding hood should be available before you start to weld. T F
3. A closed container is dangerous to weld. T F
4. Gloves are not necessary when welding. T F
5. It is dangerous to weld without proper ventilation. T F
6. An electric shock is possible if both the electrode and ground are contacted. T F



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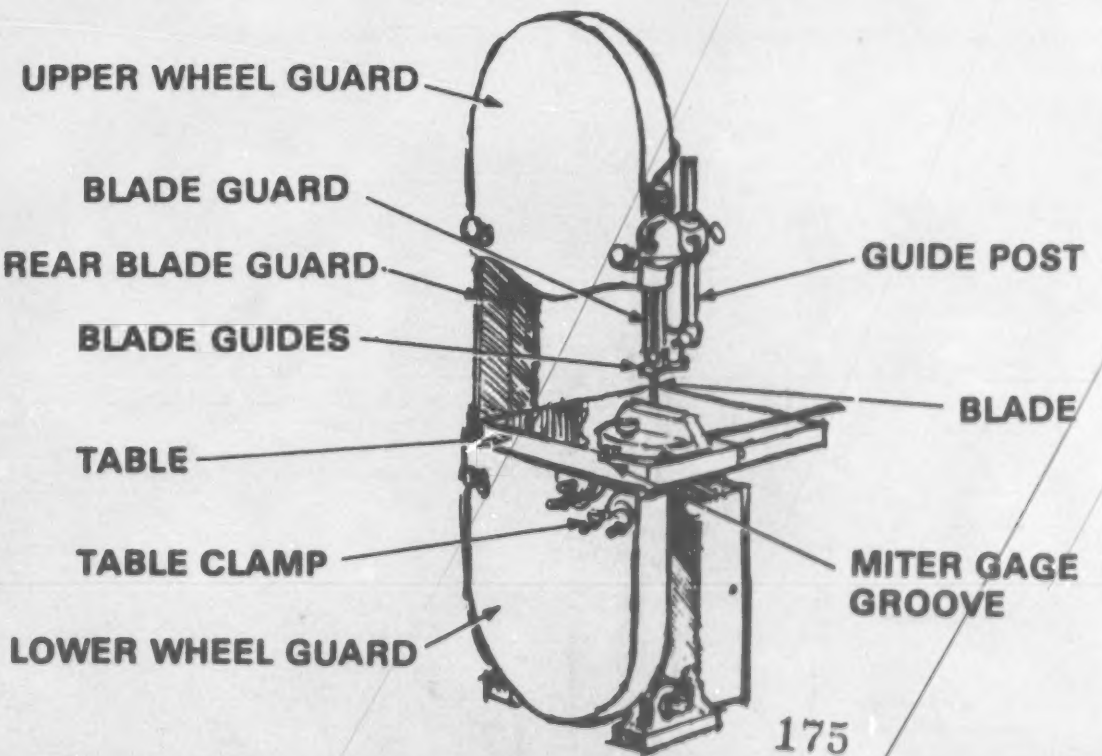
(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make sure all adjustments are tight and secure and blade guides are properly adjusted.
6. Upper blade guides should be positioned about 1/8" above the work piece.
7. Guide the work slowly, letting the machine do the work. Do not force the work into the blade.
8. Do not attempt to cut a smaller radius than the blade will allow.
9. Avoid backing out of a cut.
10. Place hands or fingers on each side of the cut line, never on the line. Use a scrap push block if necessary.
11. Never leave the machine until it has come to a full stop.



Band Saw

Name _____

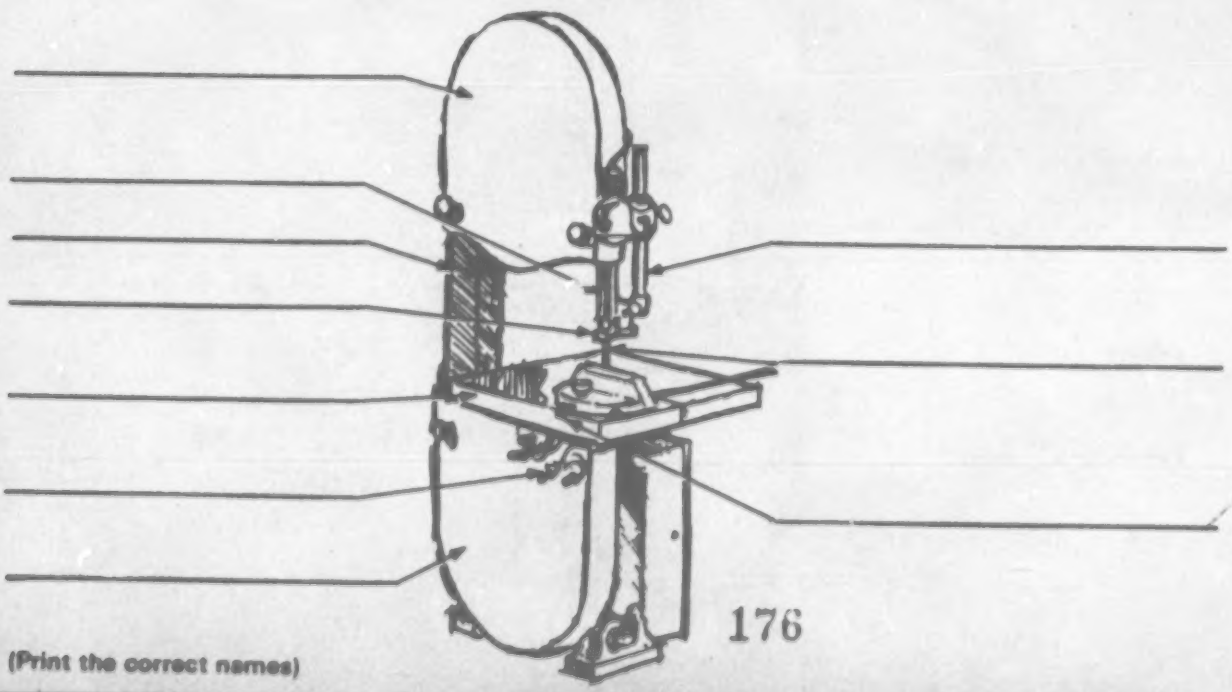
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. The lower wheel does not require a guard. T F
2. The upper guide should be adjusted to within 1/8" of the work piece. T F
3. All normal adjustments should be made with the power turned off. T F
4. It is permissible and safe to force the material around a tight radius. T F
5. Fingers should be placed on each side of the cut line and the material guided through the machine. T F
6. When necessary it is possible to back slowly out of a cut. T F

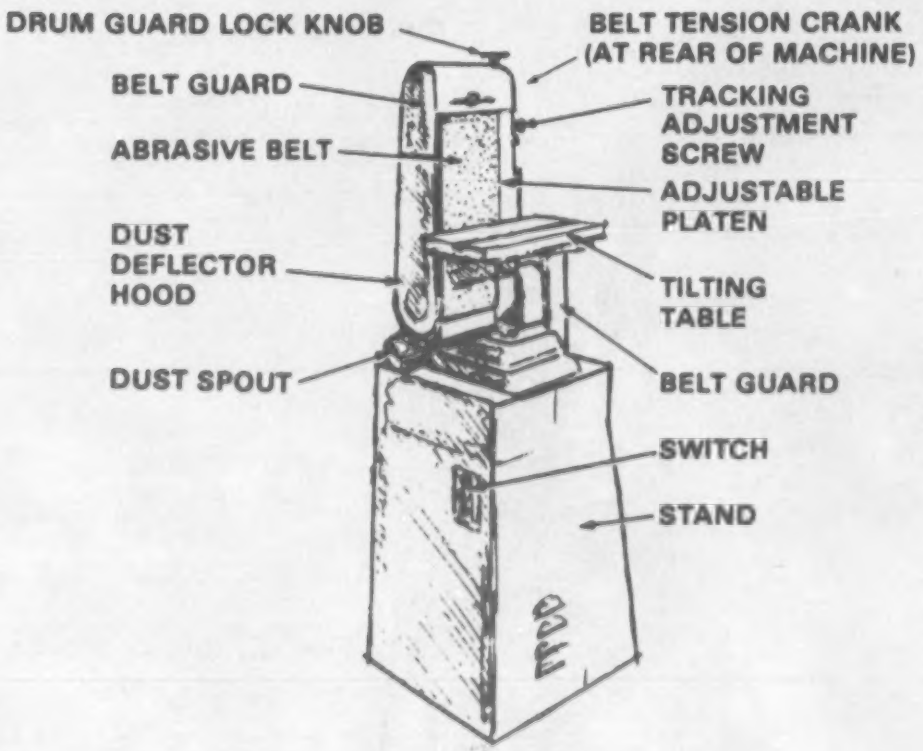


(Print the correct names)

Belt Finishing Machine

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make all adjustments except final belt tracking with the power off.
6. Make sure there is adequate strong tension on the belt and that it is not torn.
7. When changing belts make sure the new belt runs as arrows indicate.
8. The table should be adjusted to within 1/16" of the abrasive belt.
9. Keep hands clear of the abrasive belt while operating and keep material flat on the table.
10. The belt must be re-tracked if the angle of the basic machine is changed.



S

Belt Finishing Machine

Name _____

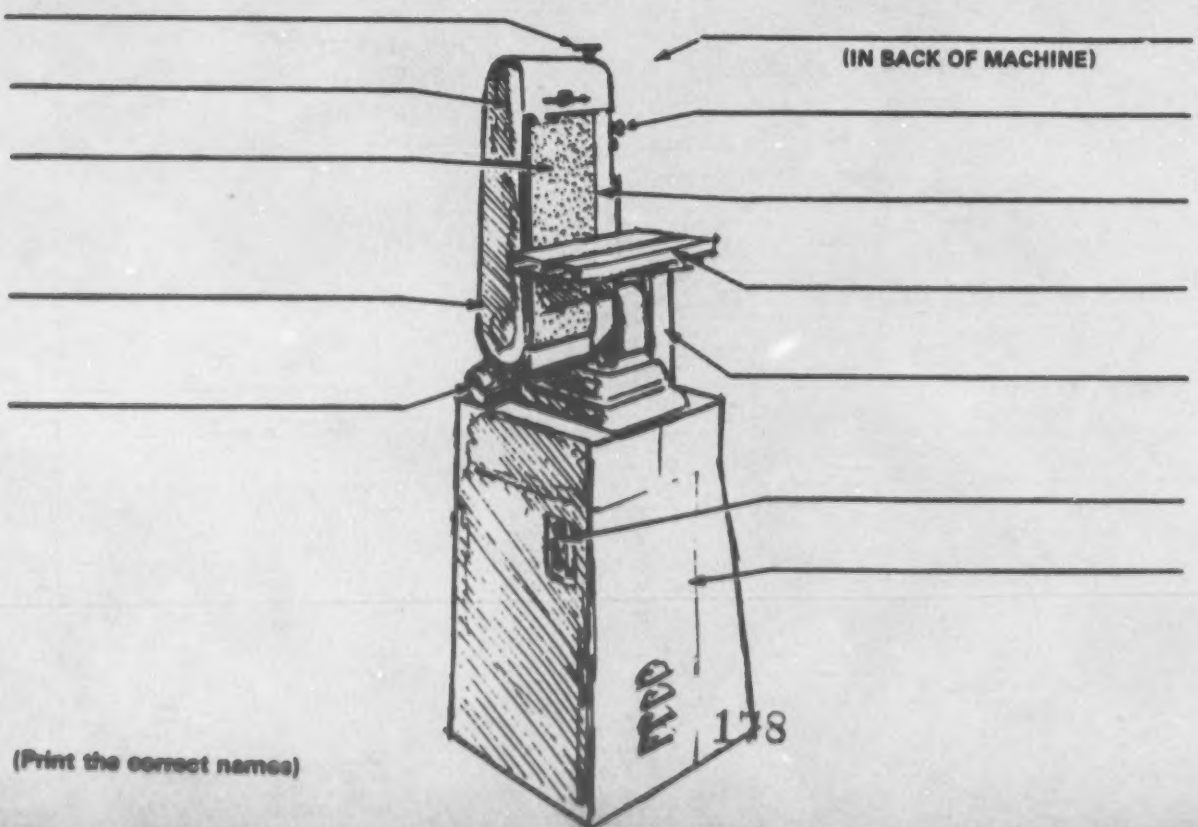
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

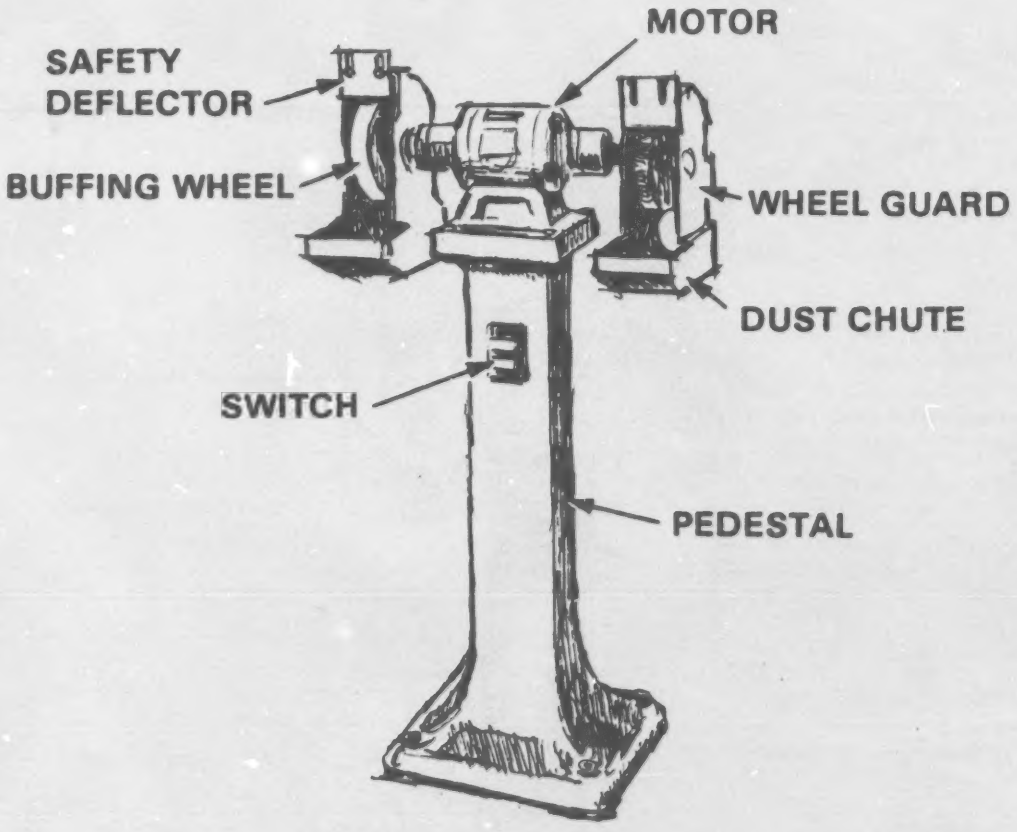
1. Material may be safely sanded in the center of the platen. T F
2. The table should be ¼" away from the belt for adequate clearance. T F
3. If the angle of the unit is changed belt tracking should checked. T F
4. There are directional arrows inside the belt. T F
5. Tne guards cannot be removed from this machine. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Always buff using the lower half of the buffing wheel.
6. Stand to one side of the wheel when buffing or applying compound.
7. Use care when buffing around corners or openings where the wheel could grab and throw the work piece.
8. Never use gloves, rags or part of a shop coat to hold the work piece.
9. Never buff a leading edge.



S

Buffer

Name _____

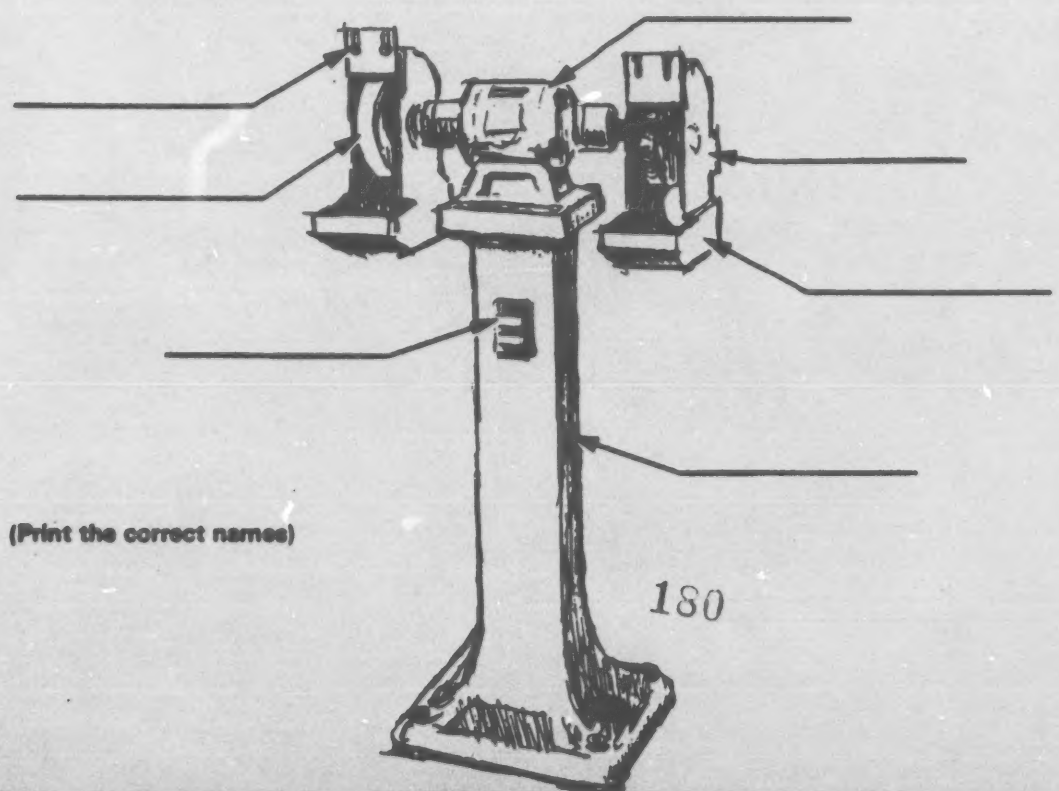
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. A rag should be used to hold hot objects while buffing. T F
2. Always buff on the lower half of the wheel. T F
3. Loose clothing or hair must be confined. T F
4. Eye protection must be worn when buffing. T F
5. Use extra caution when buffing corners or confined areas of the work. T F



(Print the correct names)

Circular Saw

S

Name _____

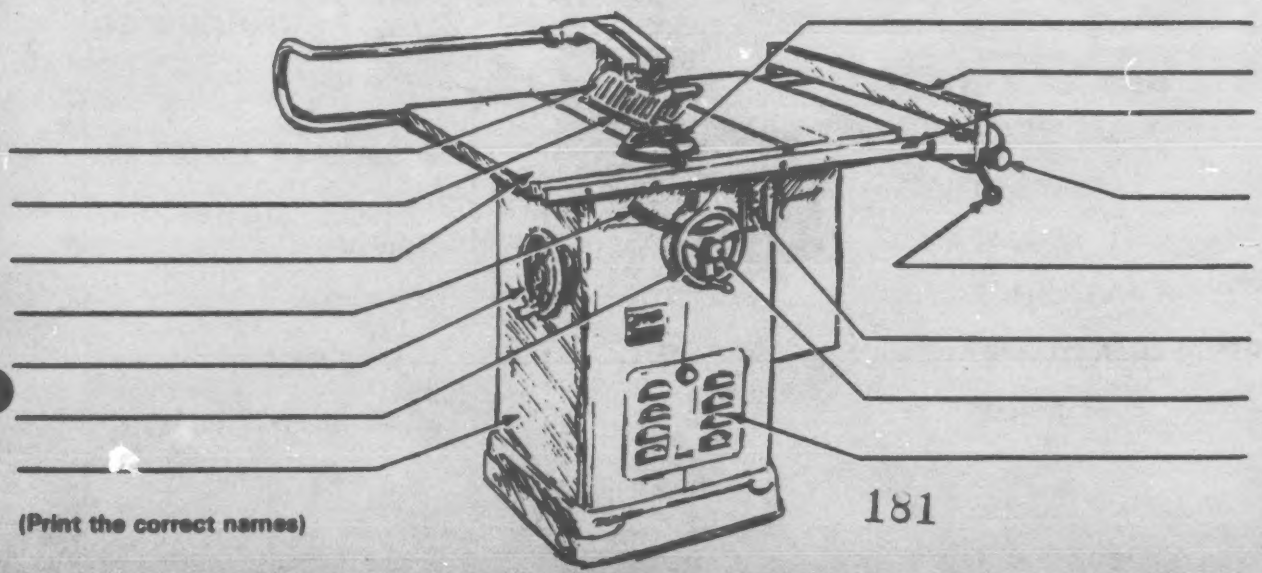
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

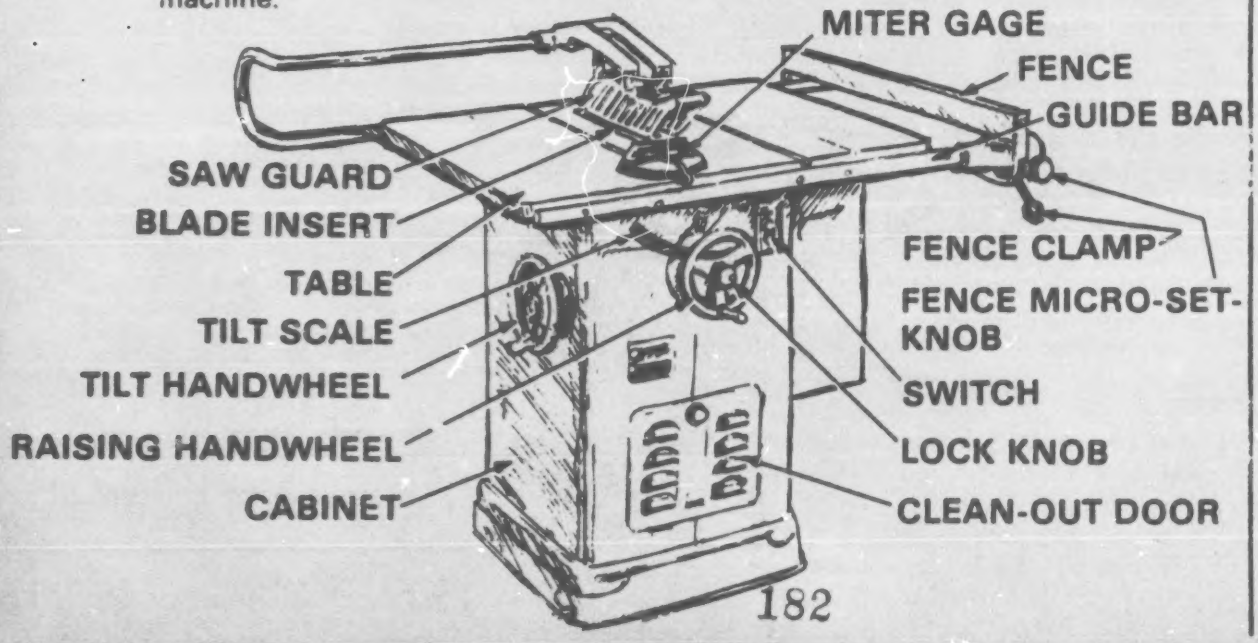
1. It is safe to saw freehand. T F
2. The fence should always be used. T F
3. The guard is not always necessary. T F
4. When ripping it is best to stand directly behind the blade. T F
5. Eye protection should be worn when using a table saw. T F
6. The saw blade should be adjusted so that the teeth clear the thickness of material to the depth of the gullets. T F
7. A helper or roller should be used when ripping long pieces. T F
8. A push stick is necessary when ripping narrow stock. T F



(Print the correct names)

For Safety —

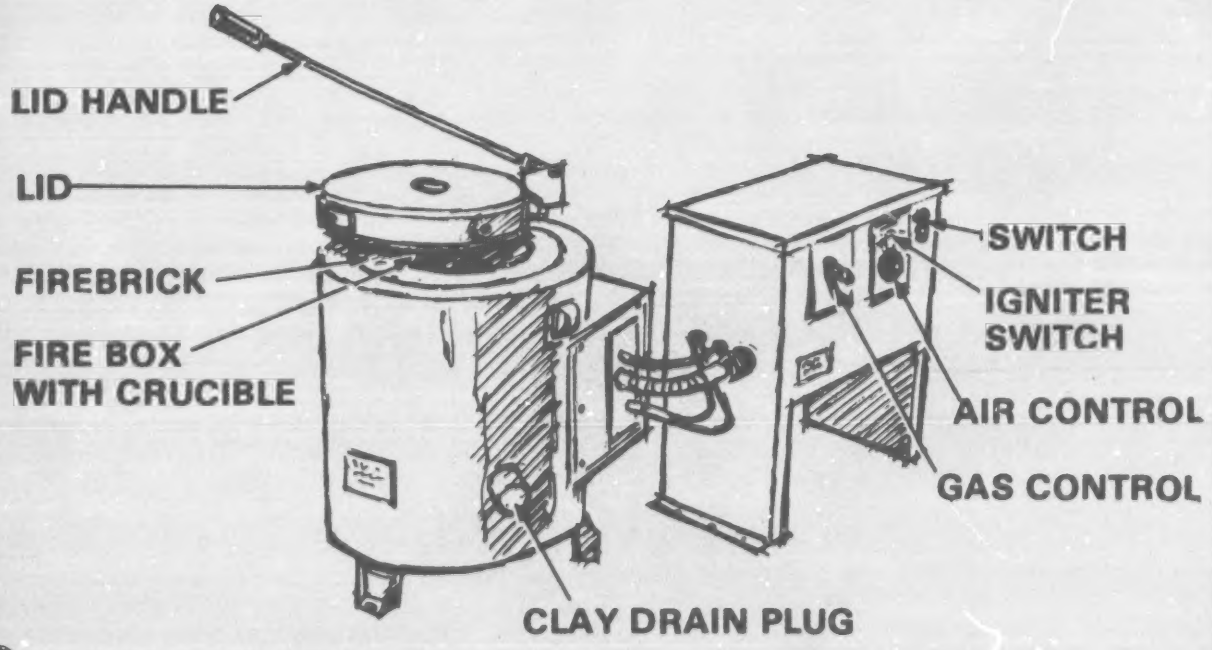
1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make all adjustments and remove chips or dust with the power off.
6. Never use the miter gage and fence together in the same operation.
7. The saw blade should extend above the work piece untill the gullets of the blade clear the material.
8. Never saw free hand. Use the miter gage when cross cutting, the fence when ripping.
9. Never reach over the saw blade.
10. Use extra care and precaution when sawing large material, or when using a dado or molding cutter head.
11. Use a push stick when ripping narrow stock or when hands would be close to blade.
12. Do not stand in line of the cut when operating the saw.
13. Lower the blade and be sure it has come to a full stop before leaving the machine.



Crucible Furnace

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Protective clothing must be worn-coat-gloves-face shield-shoes-leg protectors.
6. Do not throw metal in crucible, use tongs.
7. When pouring keep metal close to the floor and move slowly.
8. Do not step on metal spilled on the floor.
9. Be sure to pin crucible in pouring cradle.



Name _____

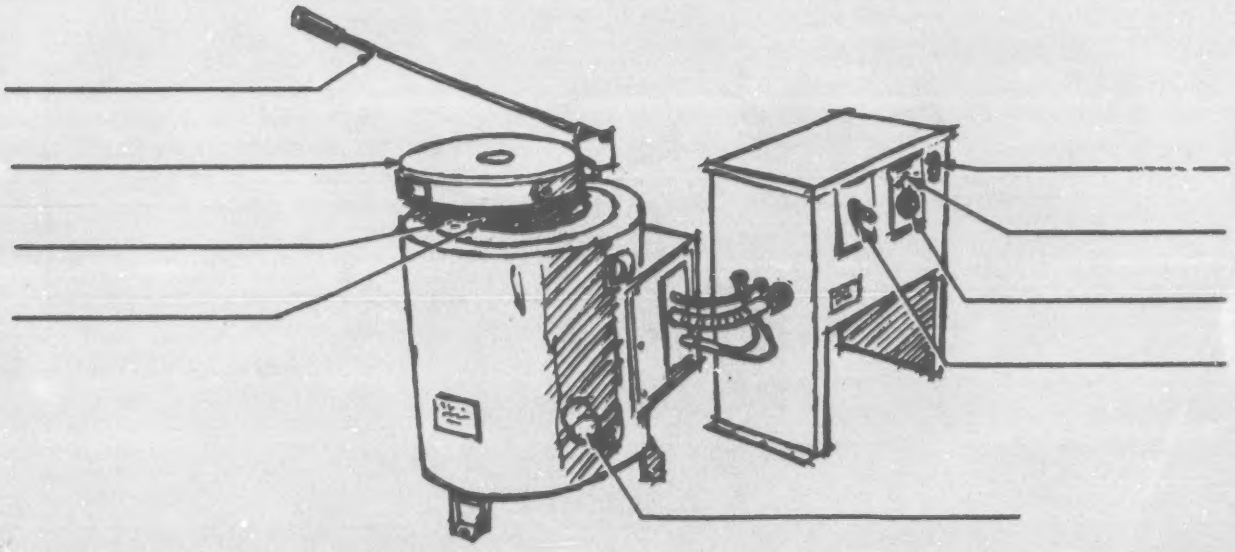
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

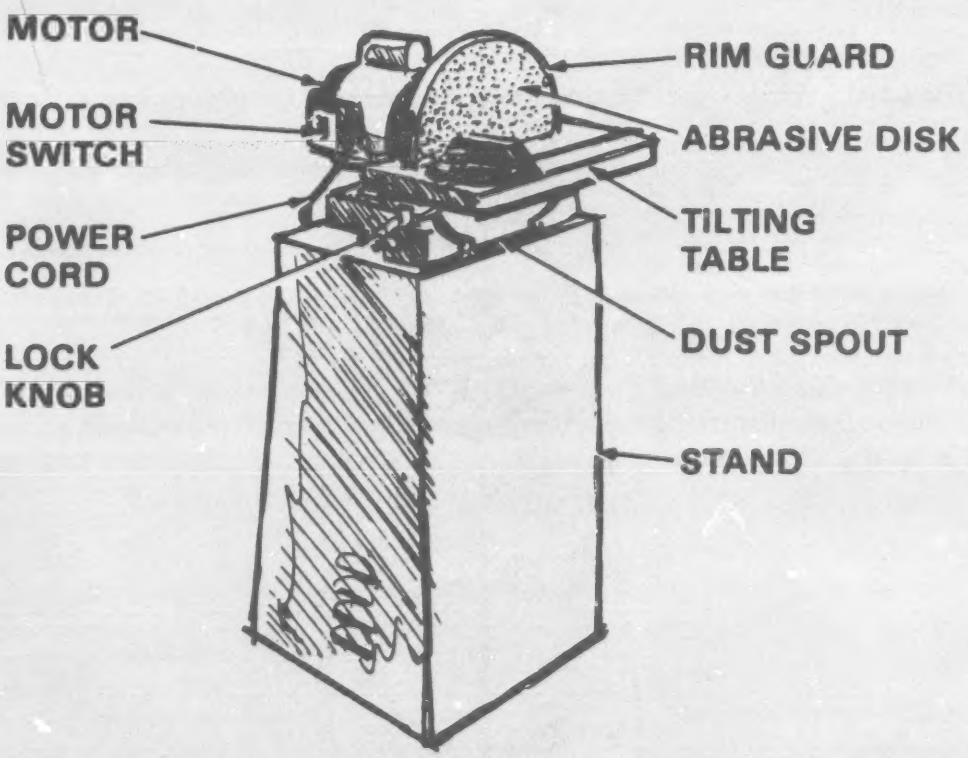
1. Metal accidentally spilled on the floor should be kicked aside. T F
2. When pouring you should move as quickly as possible. T F
3. Protective clothing is necessary when charging the crucible. T F
4. Metal should not be thrown or dropped into crucible. Tongs should always be used. T F
5. If goggles are used a face shield is not necessary. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make sure adhesive is holding abrasive disc tightly to the revolving platen.
6. Abrasive disc should not be torn or damaged.
7. Material should be held flat against the table and hands kept clear of the abrasive disc.
8. The table should be adjusted to within 1/16" of the disc.
9. Work must be done on the side of the disc rotating downward.
10. Do not leave this machine until it has coasted to a full stop or been stopped with a piece of scrap wood.



Disc Finishing Machine

S

Name _____

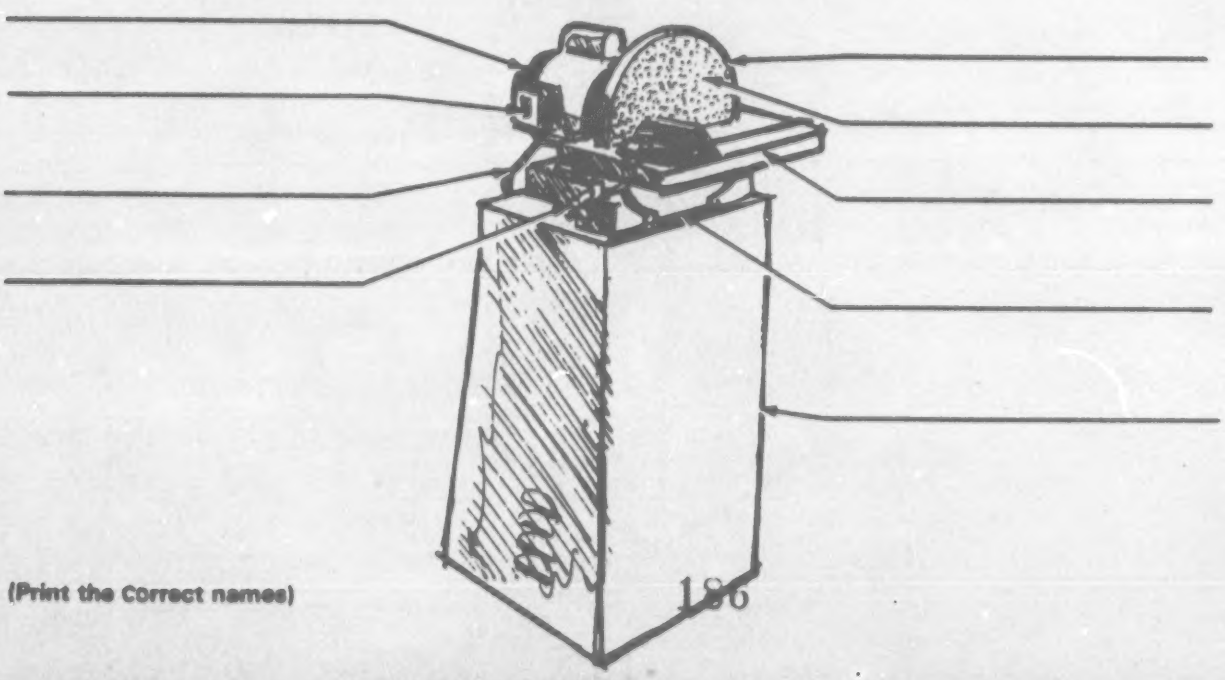
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. Sanding can be safely done on either the left or right side of the rotating disc. T F
2. The Rim Guard is of no real value and can be removed for most operations. T F
3. The table should be adjusted to within 1/16" of the disc. T F
4. A piece of scrap lumber can be used to slow down and stop the disc after turning off the power. T F
5. The table may be tilted safely while the machine is running. T F

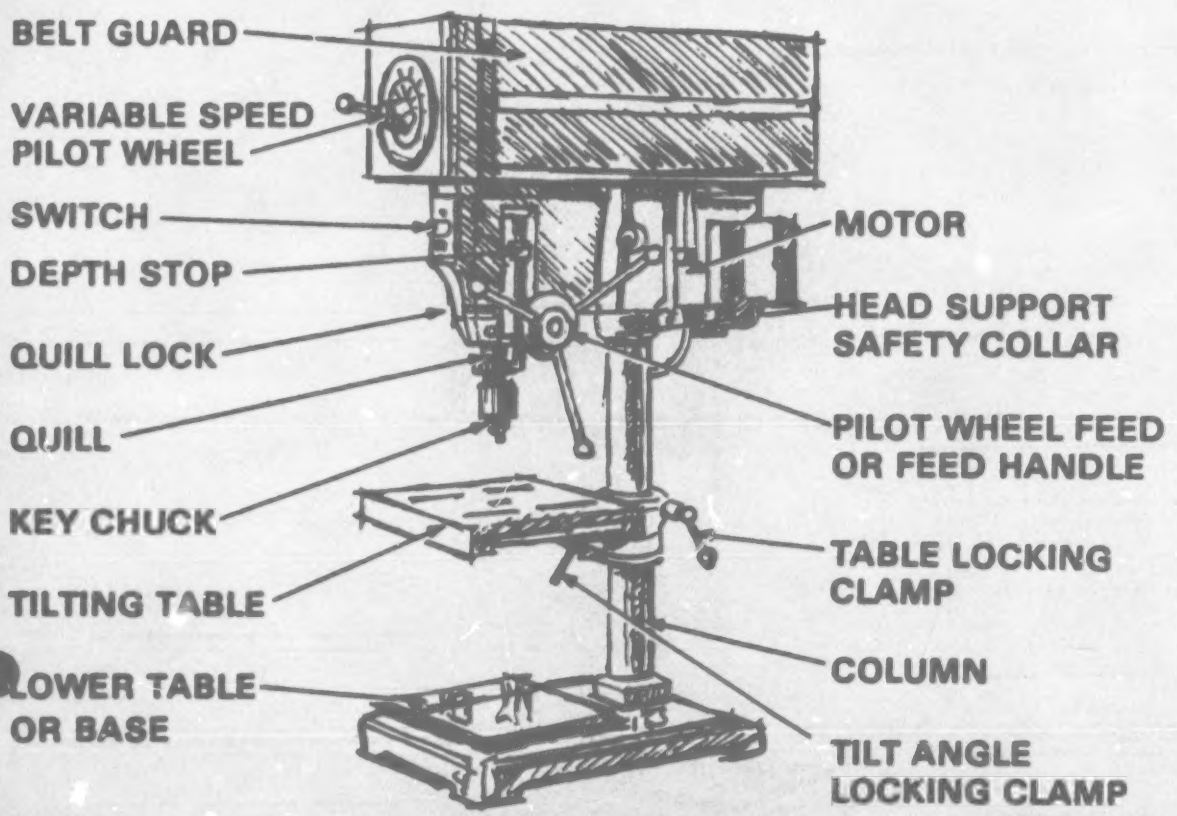


(Print the correct names)

Drill Press

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Hold material securely with vise or clamps.
6. Be sure key is removed from chuck.
7. Select a properly sharpened bit. For metal, center punch when hole is to be drilled.
8. Turn off power if work piece is caught in the drill. Do not stop by hand.
9. Adjust table or depth stop to avoid drilling into the table.
10. Select the correct speed, normally slower for metal-faster for wood. The larger the bit, the slower the speed.



S

Drill Press

Name _____

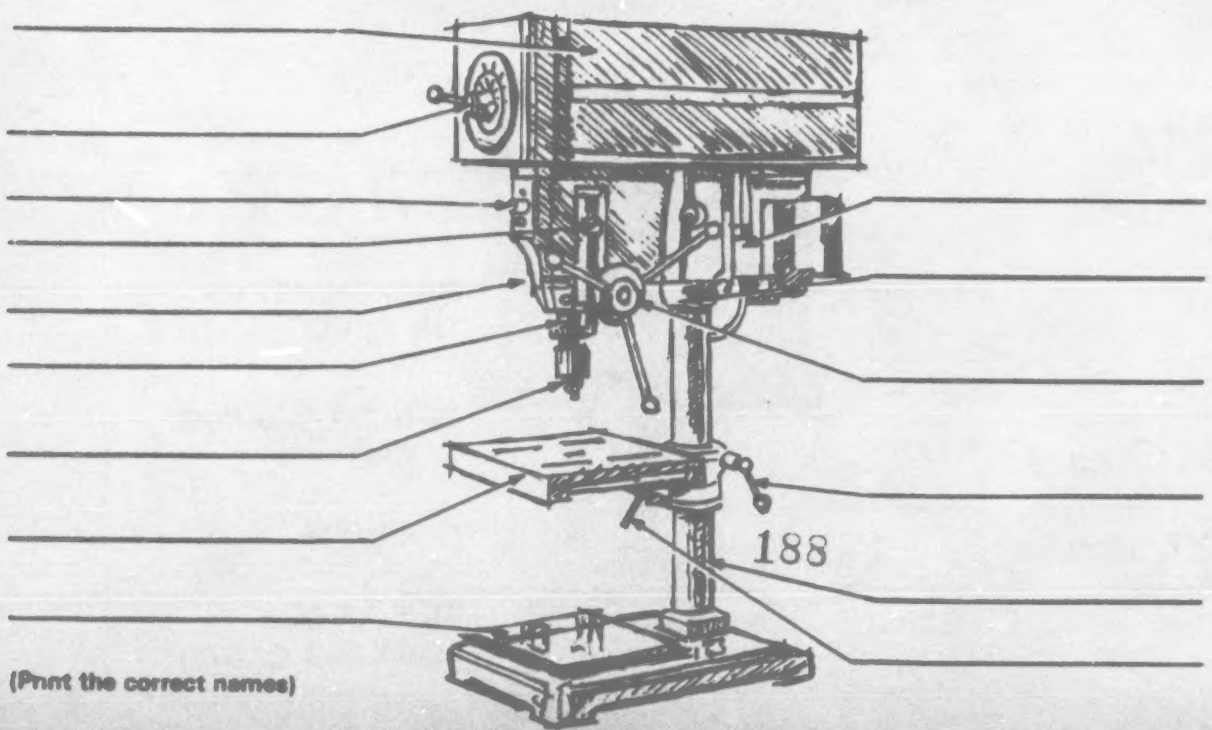
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

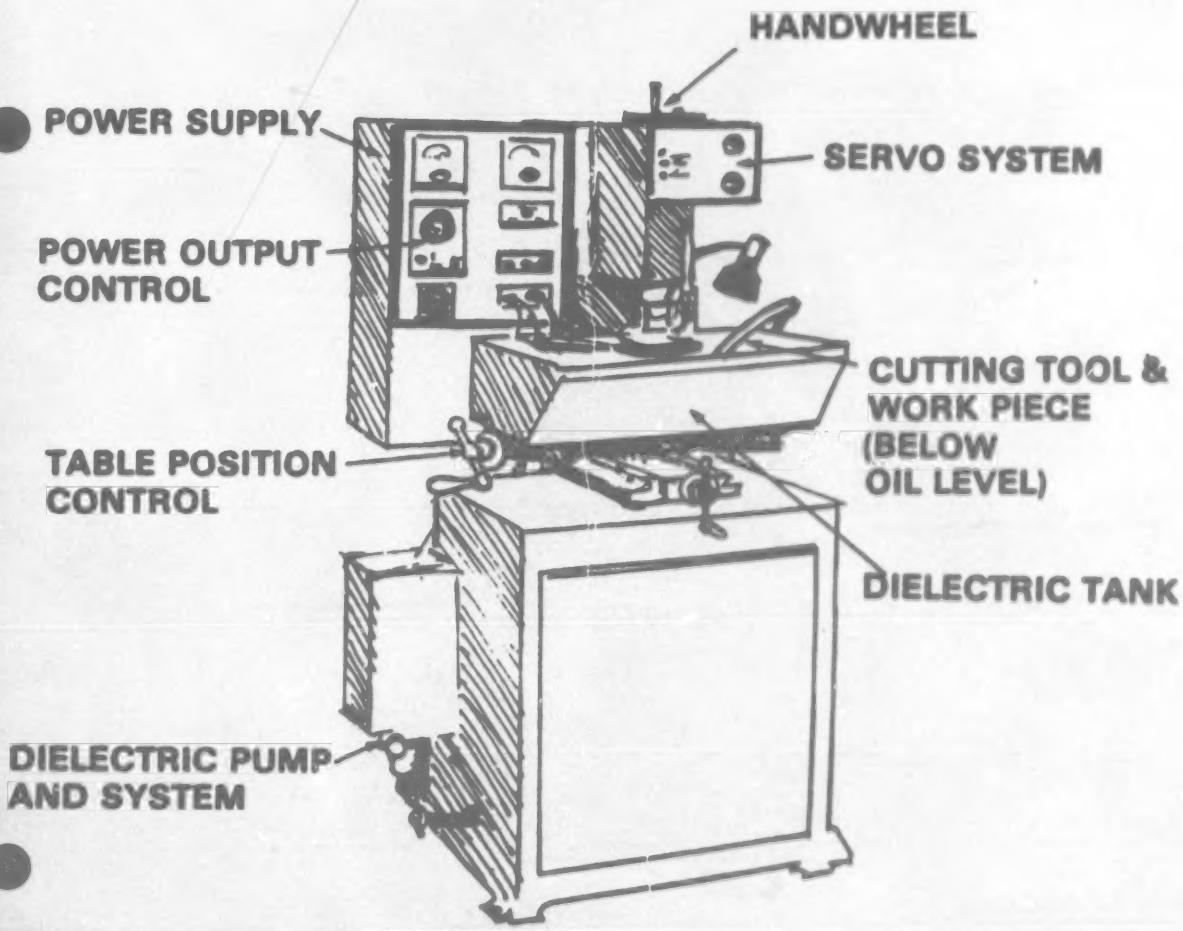
1. It is necessary to select the proper speed. T F
2. The chuck key should be kept in the chuck at all times. T F
3. Work should always be secured. T F
4. Rings may be worn while operating a drill press. T F
5. A chip brush should be used for removing chips. T F
6. The drill should be operated at top speed for all work. T F
7. The long end of the work should be to the left of the operator. T F



(Print the correct names)

For Safety —

1. Operate only with instructors permission and after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. Observe the tool voltage (300 volts) and keep clear of all charged areas
6. Be sure to discharge the tool at the end of a cut.
7. If you spill oil, clean it up.
8. Do not activate the power supply until the dielectric oil tank is full and oil covers the workpiece.



Electric Discharge Machine (EDM)

8

Name _____

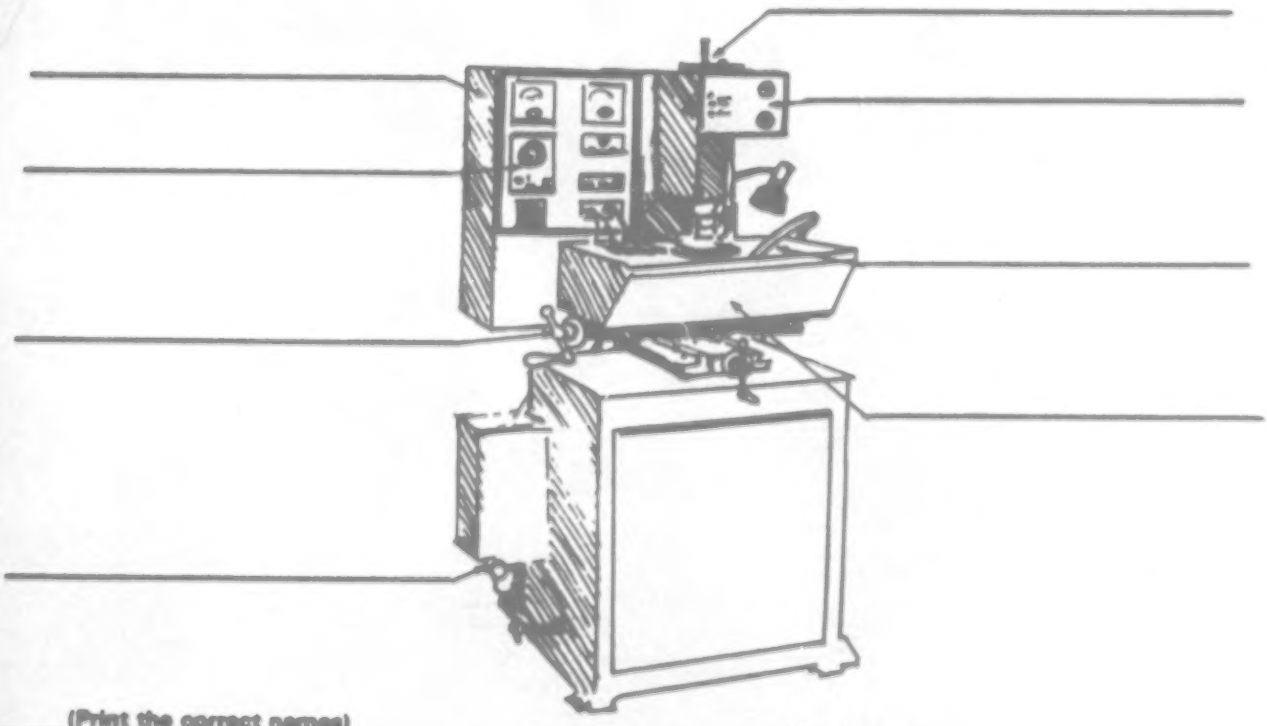
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

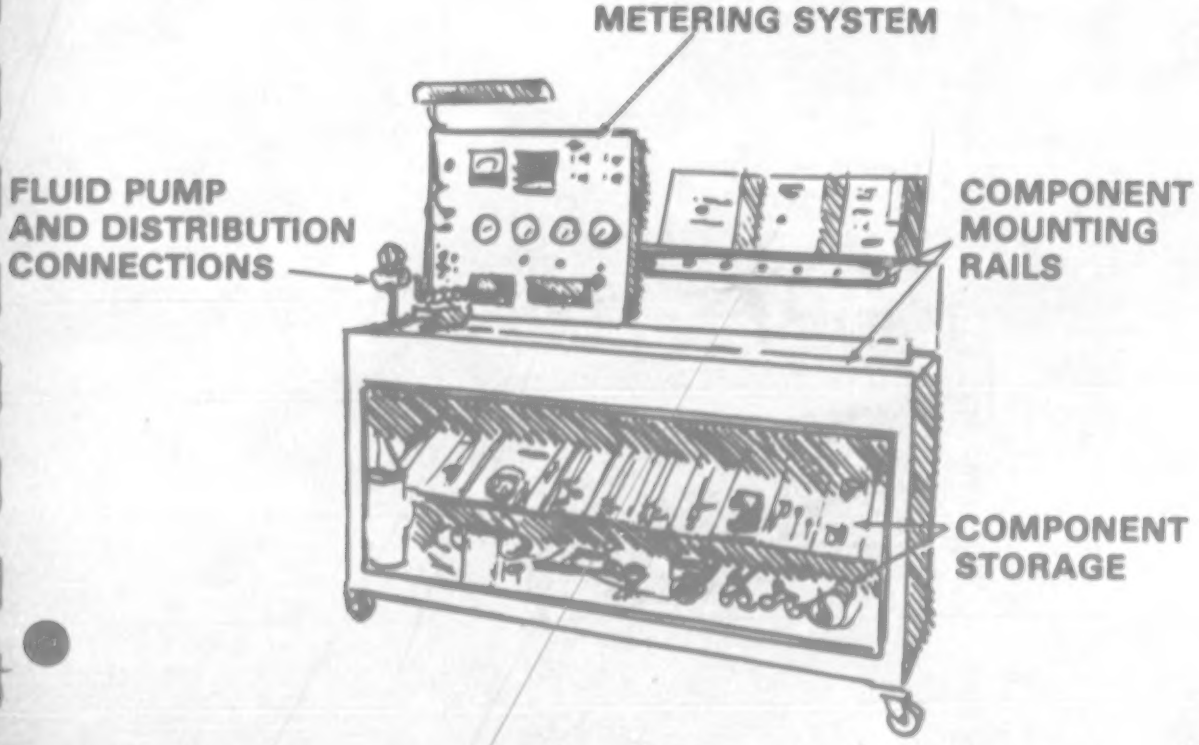
1. The tool must be discharged on completion of a cut. T F
2. Oil must cover the workpiece and the tank should be full before activating the power supply. T F
3. All spilled oil must be cleaned up, or wiped off the machine. T F
4. The tool voltage is not high enough to be dangerous. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Clean up all fluid spillage.
6. Exercise caution when disconnecting fluid system.
7. Make sure all components are securely fastened, and properly connected before operating unit.



Hydraulic Training Unit

S _____

Name _____

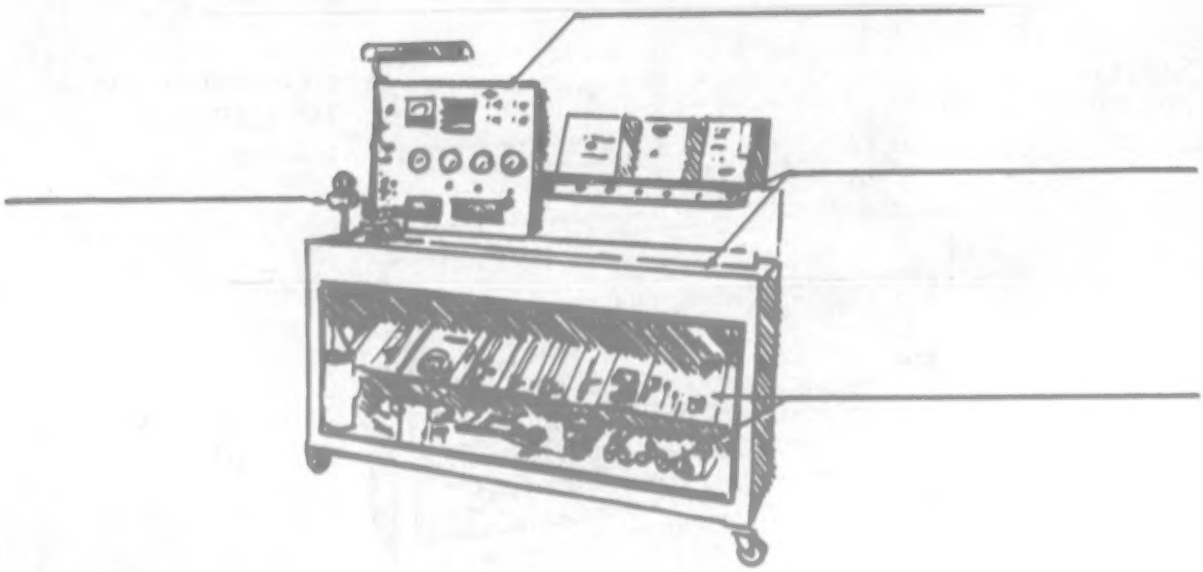
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. All components must be securely fastened before operating the unit. T F
2. Extreme caution must be used when disconnecting the components. T F
3. Eye protection is not required when operating this unit. T F
4. Fluid spills should be cleaned up immediately. T F



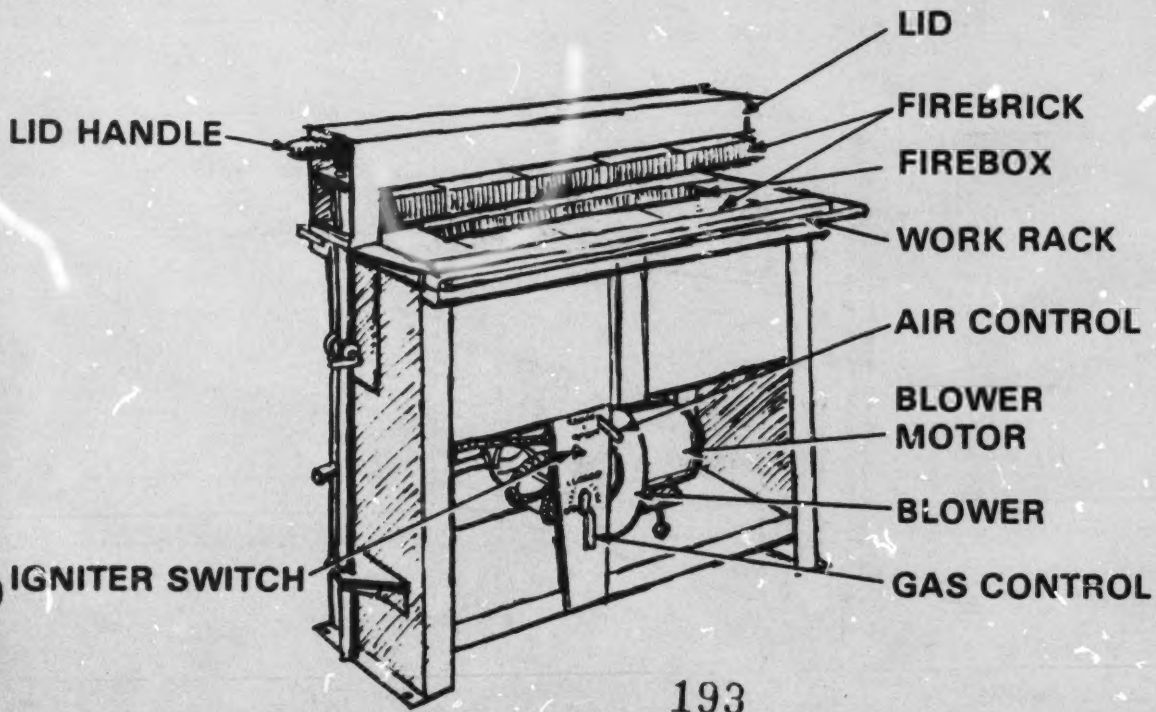
192

(Print the correct names)

Gas Forge

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. The top must be open when lighting the forge.
6. Sequence directions for igniting air and gas must be followed exactly.
7. Asbestos gloves must be worn when tongs are not used.
8. Hot metal left unattended must be marked "HOT" with chalk.
9. When shutting down turn gas off first.



S

Gas Forge

Name _____

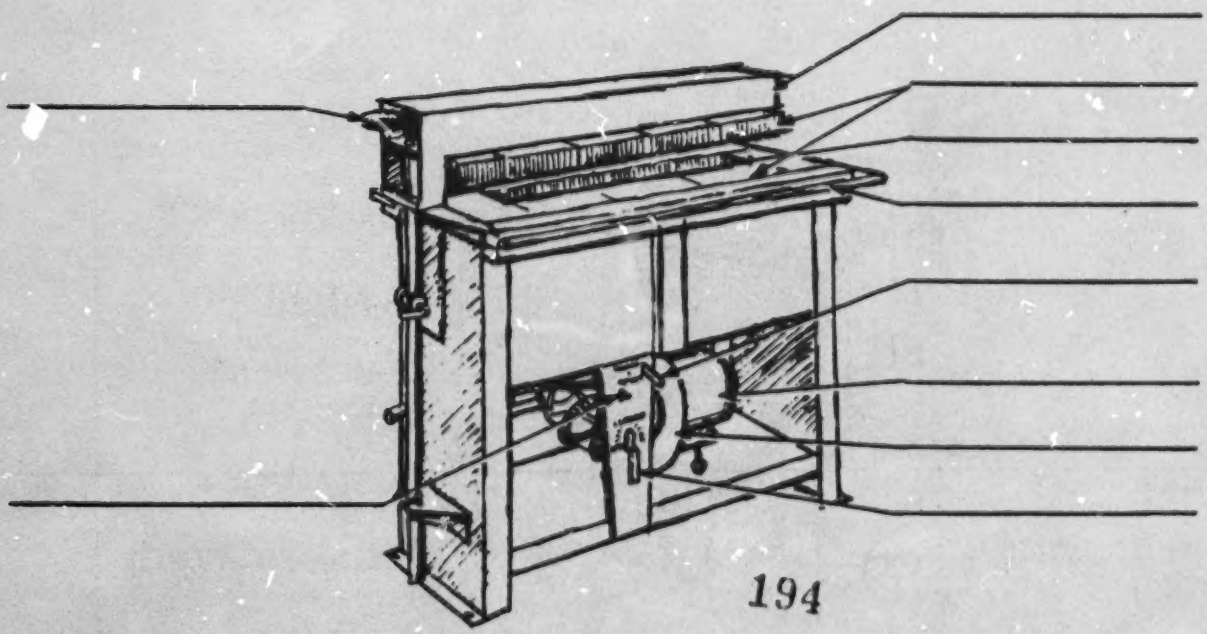
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

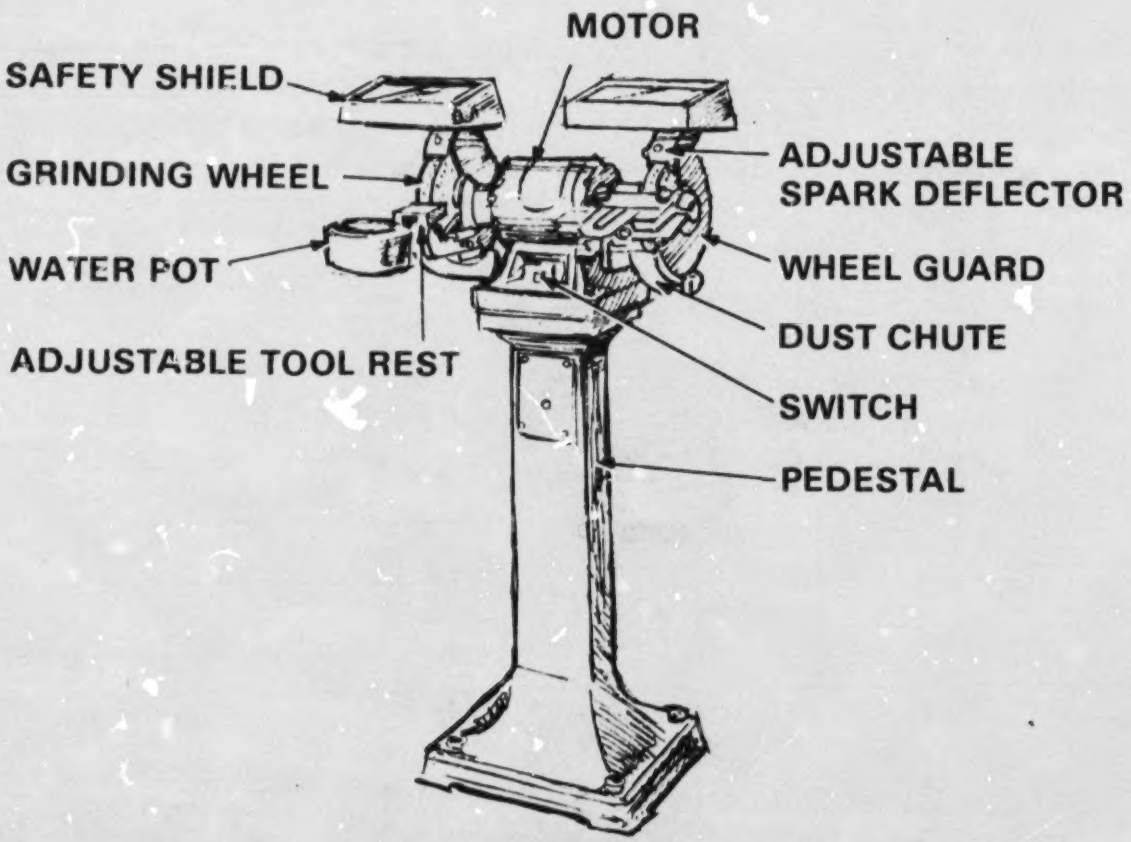
1. Tongs should be available for the handling of hot metal. T F
2. Gloves should be worn when handling the tongs. T F
3. The top slot should be closed when lighting the forge. T F
4. The air should be turned off first when shutting down. T F
5. Hot metal should be marked "HOT". T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. The tool rests must be adjusted to within 1/13" of the grinding wheel.
6. Spark deflectors must be adjusted to within 1/16" of the grinding wheels.
7. Do not grind on the side of the grinding wheels.
8. Stand to one side when starting the machine.
9. Discard or report grinding wheels that are excessively small or cracked.
10. Small work pieces should be held with "vise grip" type pliers.
11. Do not leave the machine until the grinding wheels have come to a full stop.



S

Grinder

Name _____

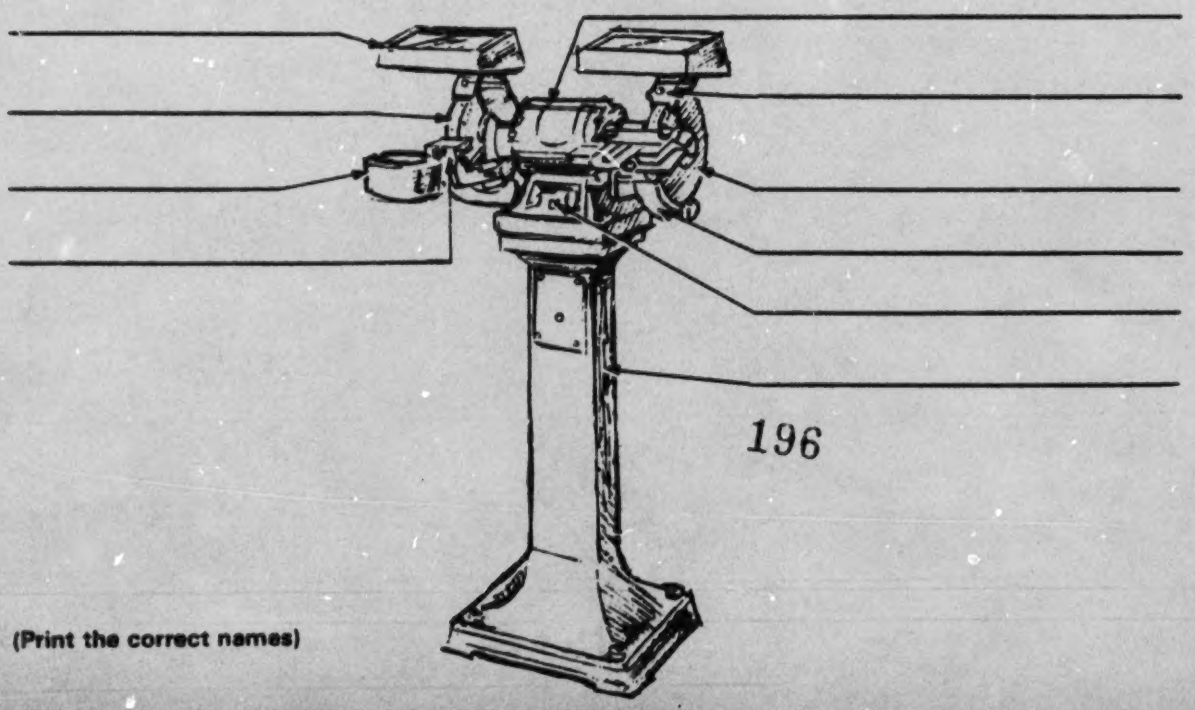
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. The tool rest should be adjusted to within 1/2" of wheel. T F
2. Eye protection is always necessary while grinding. T F
3. Once the "off" switch is in the off position, the operator may leave. T F
4. Wheels that are slightly cracked may be used. T F
5. The spark arrestor is not necessary if there is a safety shield. T F
6. When grinding a small piece of steel, "vise grips" are advised. T F



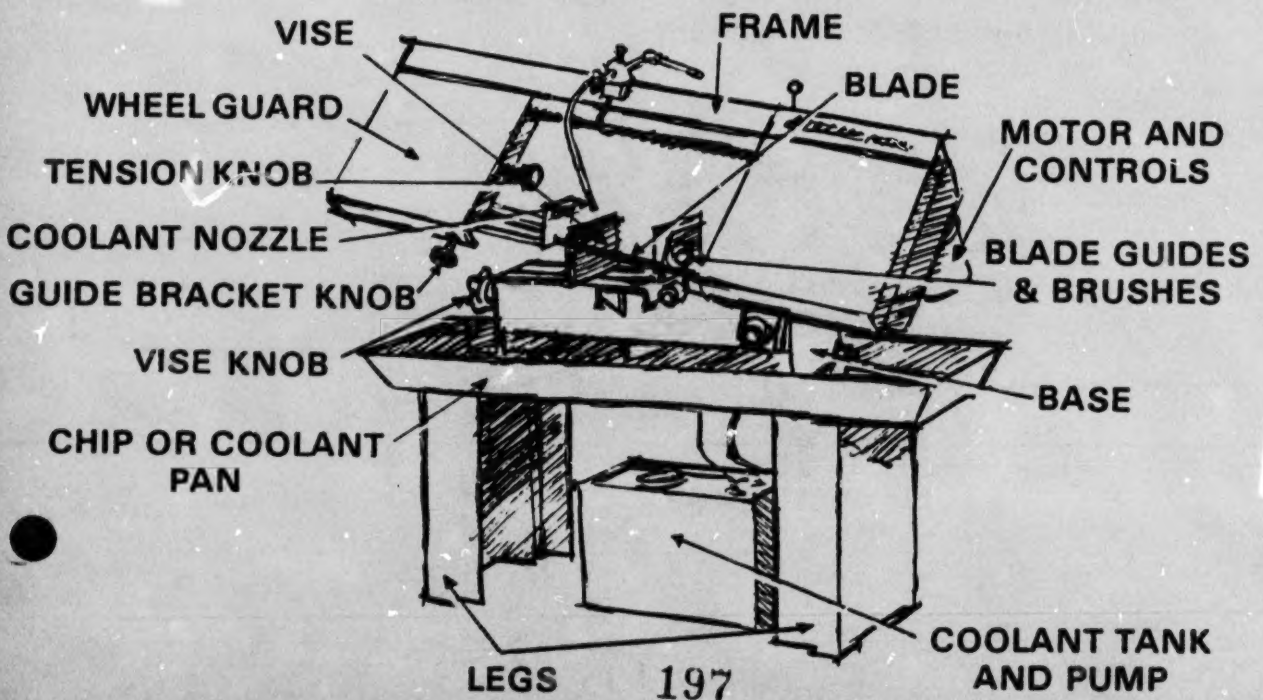
196

(Print the correct names)

Horizontal Band Saw

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. All adjustments to the chip removal brushes, blade tension, guides, vise, or drive system should be done with the power off.
6. Be sure blade guides are properly adjusted to both the blade and the work size or vise before starting cut.
7. Adjust feed rate so blade does not bounce or plunge into work when starting the cut.
8. Be sure work is tightly clamped in the vise and properly positioned for an efficient safe cut.
9. Keep hands away from cutting area and brush away chips only when the machine is turned off.
10. If the material requires coolant be sure the system is working and the correct coolant is used.



Horizontal Band Saw

S

Name _____

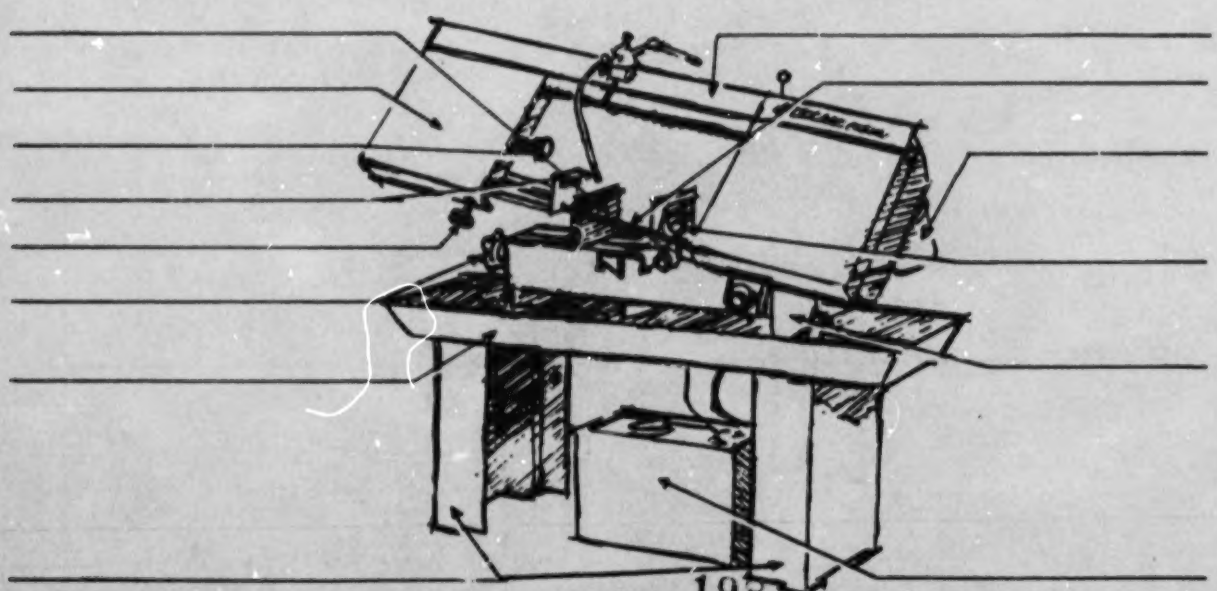
Class _____

Date _____ Grade _____

Safety Quiz

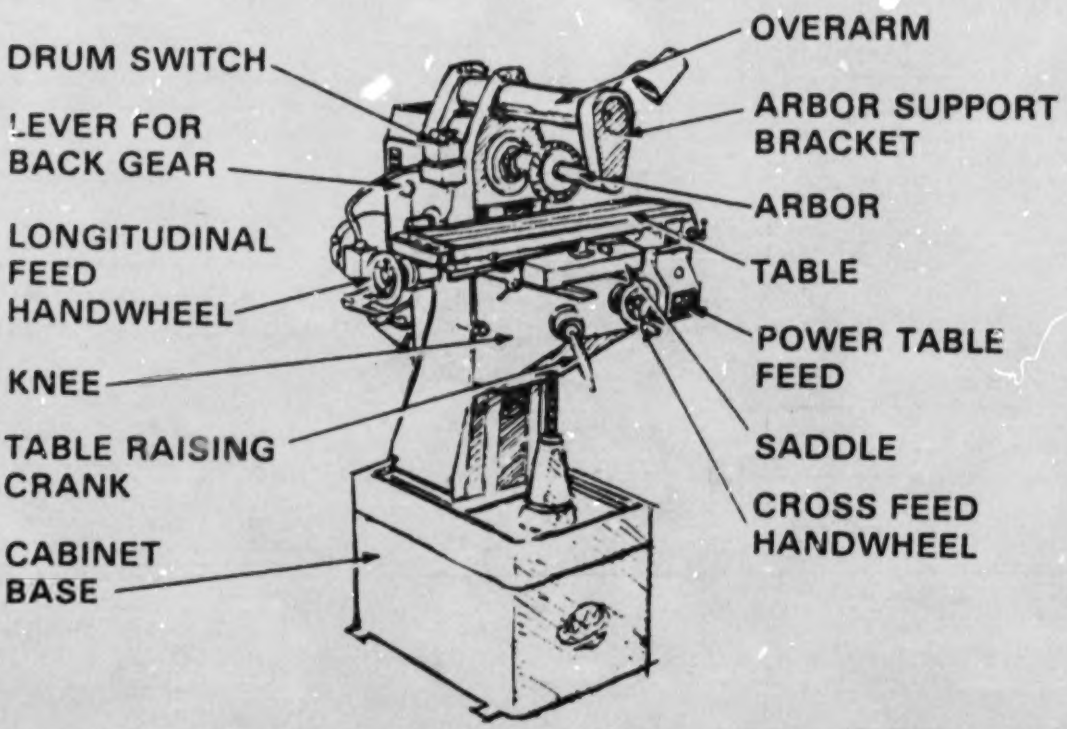
(Circle True or False)

1. Chips or dirt in the vise may cause inaccuracy but does not affect safety. T F
2. It is safe to apply slight pressure to the saw frame to increase the speed of the cutting action. T F
3. Blade guides should be adjusted to the blade and to the size of the work piece or vise. T F
4. Chips should be removed only when the machine is stopped. T F
5. If the cut is not straight the problem is probably with the material. T F
6. The work piece must be properly positioned in the vise, in addition to just being held securely. T F



For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make all adjustments with the power off.
6. Be sure cutter is tightly held in arbor or collet and material is securely held by a vise, clamps, or magnetic chuck.
7. Do not climb cut with out specific permission.
8. Check depth and width of cut, cutter rotation, plus speed of cutter and power feed before starting the machine.
9. Never clear chips away while machine is in operation. Keep hands away from chips and the point of operation.
10. Remain with the machine for the duration of the cut.



S

Horizontal Milling Machine

Name _____

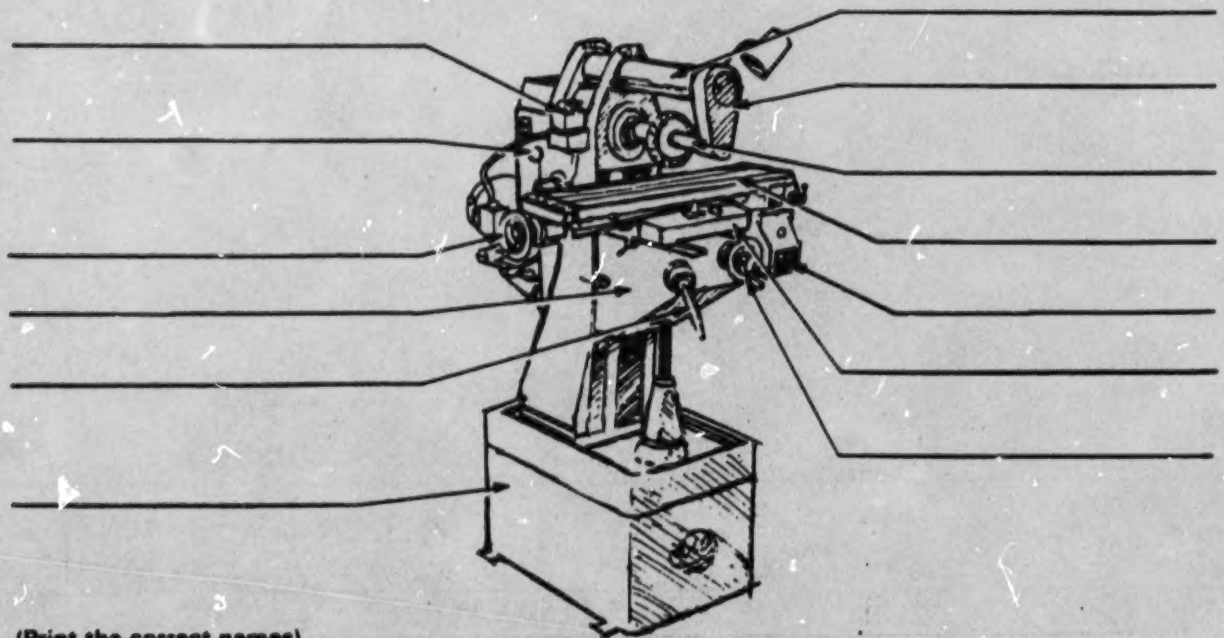
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

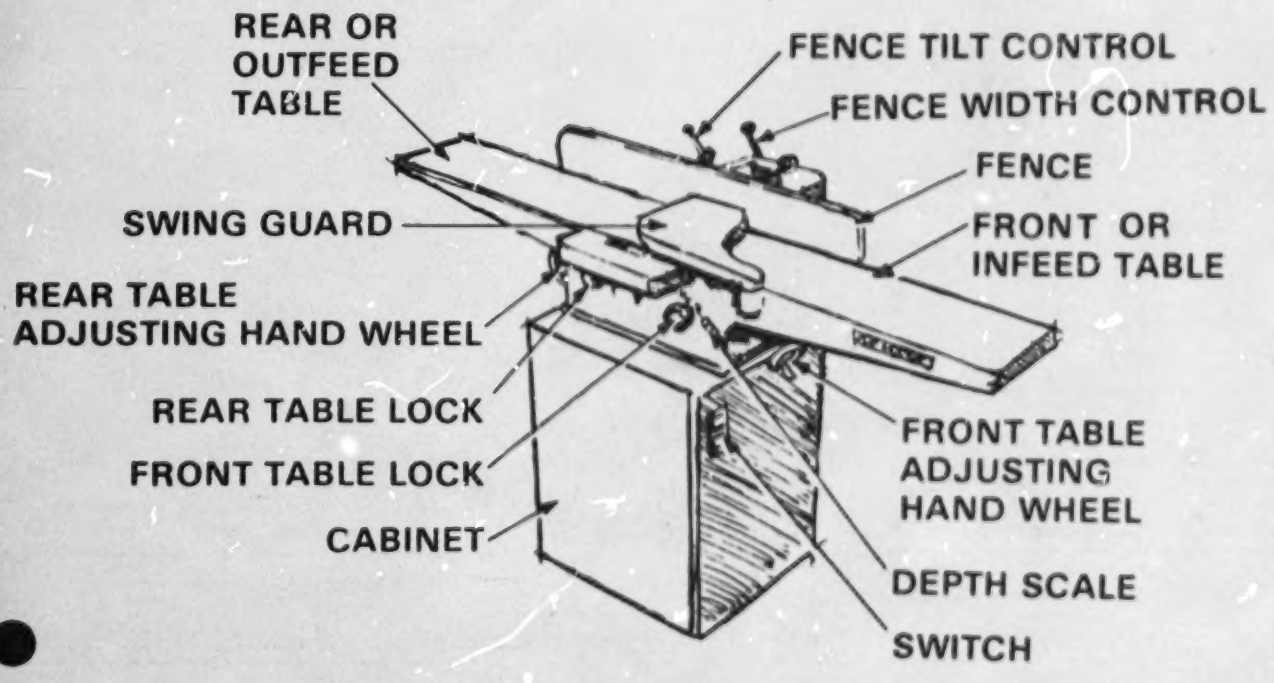
1. Small chips can be safely wiped away by hand if the machine is stopped. T F
2. While on automatic or power feed it is permissible to leave the machine. T F
3. Permission must be obtained to climb cut. T F
4. Since they are very sharp, cutters should be handled carefully. T F
5. All adjustments must be made or checked with the power off. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make all adjustments with the power turned off.
6. A push stick or push block must be used when hands would pass over-or within 2" of the cutter head.
7. Make several light cuts (1/16" to 1/8") instead of one heavy cut (1/2").
8. The absolute minimum length of material that may be jointed is twice the size of the knives - 6" jointer, 12" - 8" jointer, 16".
9. Do not adjust or move the rear or out feed table without permission.



S **Jointer**

Name _____

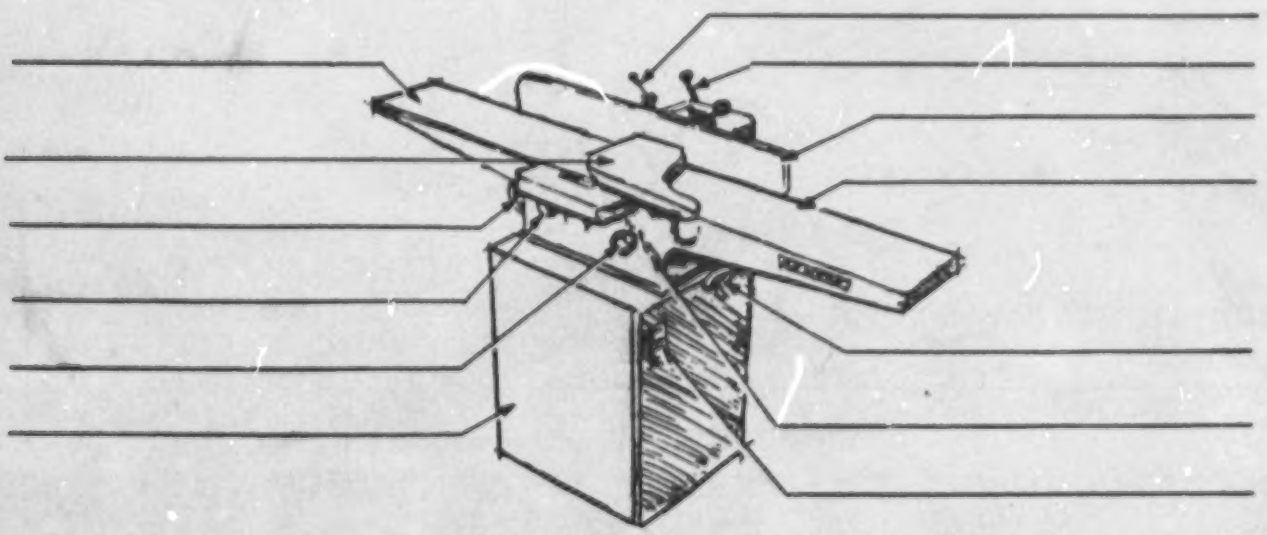
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

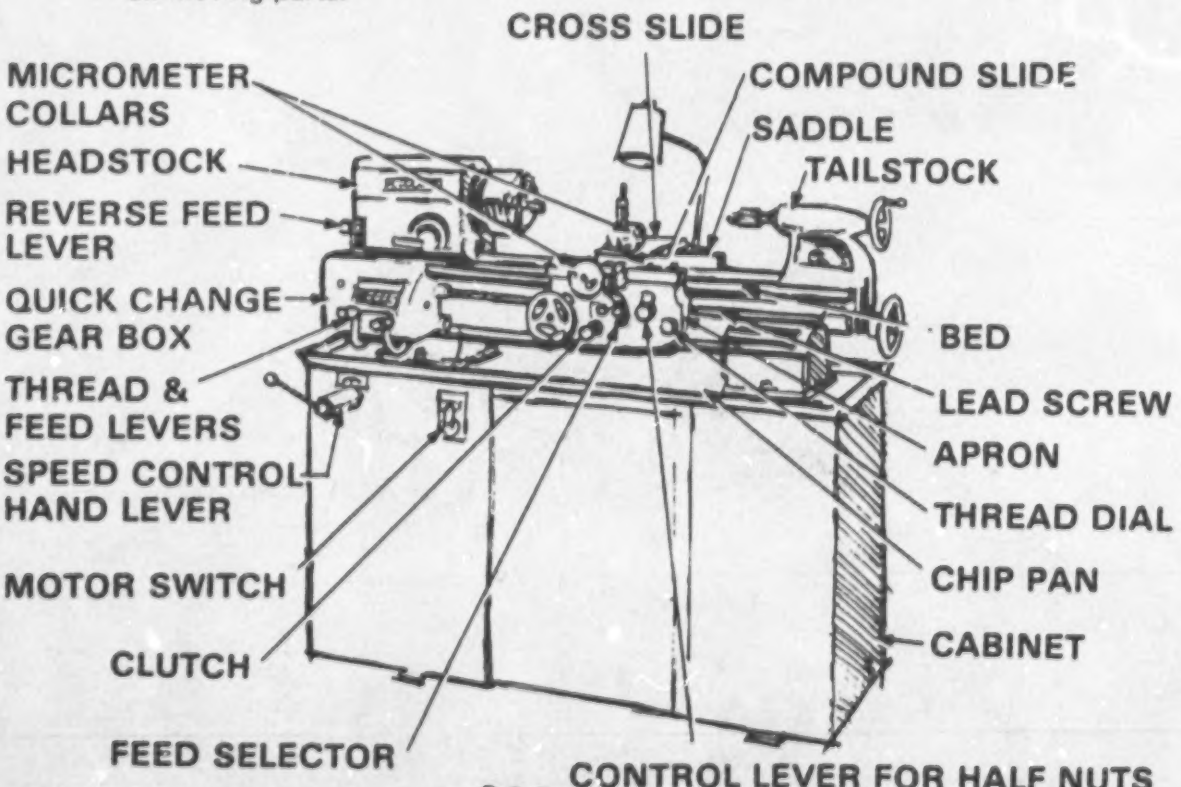
1. It is possible for the guard to stick and not cover the cutter. T F
2. A push stick should be used when the hands could get close to the cutter. T F
3. Eye protection is not necessary when operating a jointer. T F
4. Permission should be obtained before using the jointer. T F
5. Stock shorter than 6" may be processed on the jointer. T F
6. In order to remove 3/8" you should make three passes 1/8" deep. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Never leave the chuck key in the lathe chuck.
6. Rotate spindle by hand to check clearance before engaging power.
7. Remove chips with a brush, never by hand.
8. Make sure work is secure and lathe is set at correct speed and feed before starting cut.
9. Handle chucks and face plates carefully. Never adjust tool bit when tool holder is hand held.
10. Remove tool holder and tool post before filing or polishing.
11. Do not hand stop a lathe chuck, allow it to coast to a stop. Keep hands away from all moving parts.



Name _____

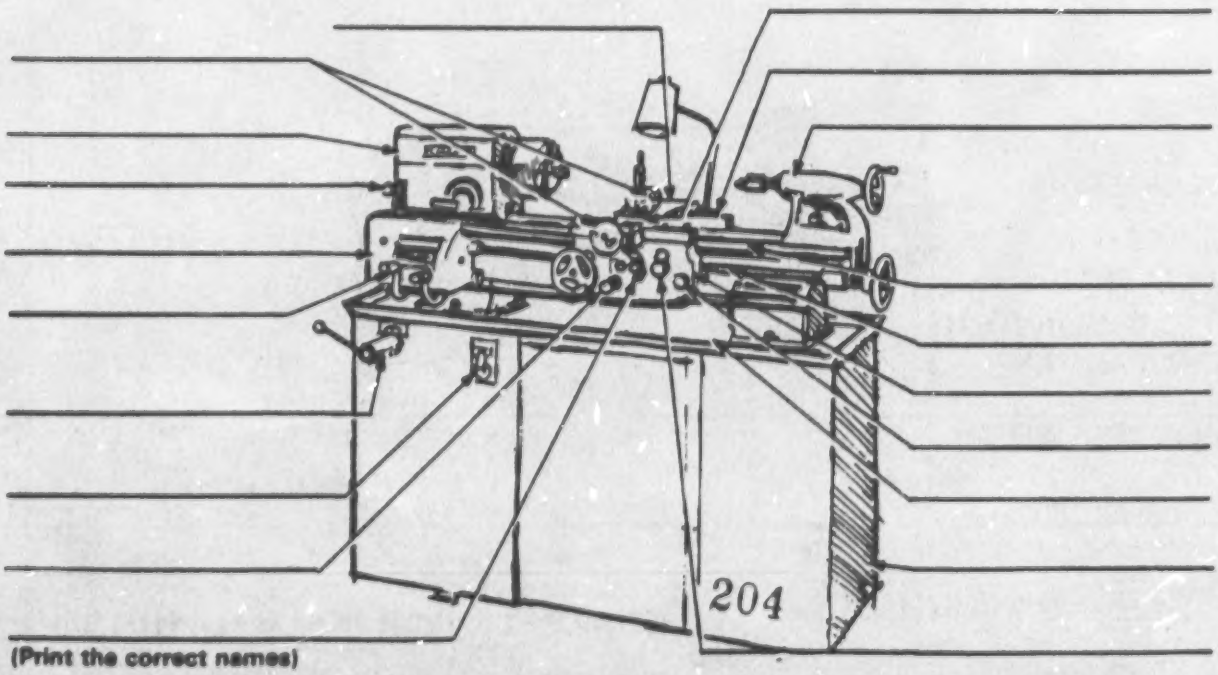
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

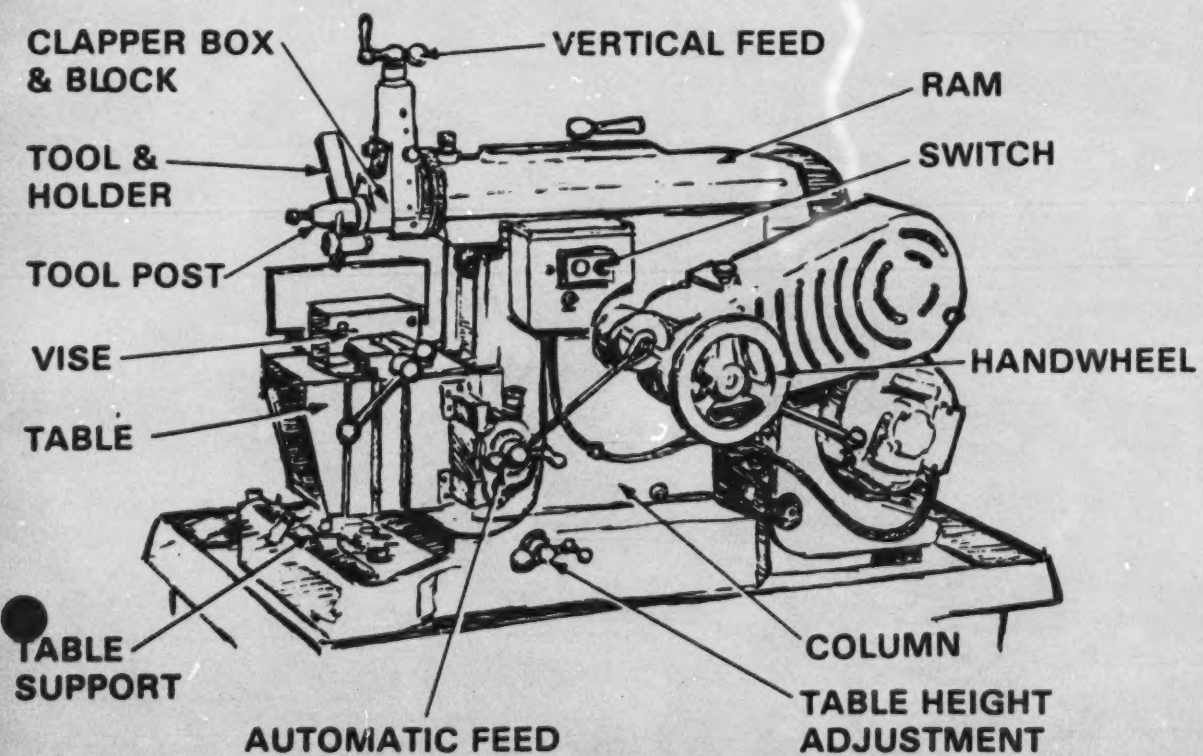
1. A brush should be used for removing chips. T F
2. The tail stock need not be secured to the bed. T F
3. The chuck wrench remains in the chuck when the machine is stopped. T F
4. It is safe to turn machine by hand before starting. T F
5. Measurements should be made while the machine is stopped. T F
6. The tool bit should be adjusted only when the tool holder is locked in the tool post. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make adjustments while the machine is stopped and run through one cycle by hand as a check for clearance.
6. Make sure all guards are secure before starting the machine.
7. Be sure the work piece is securely held in the vise or holding device.
8. Avoid standing directly in front of the ram.
9. Keep hands away from the work point or possible pinch point of the shaper.
10. Do not lay tools or tooling on any part of the machine.
11. Never remove chips while the machine is in motion.
12. Before leaving make sure the shaper comes to a full stop.



S _____

Name _____

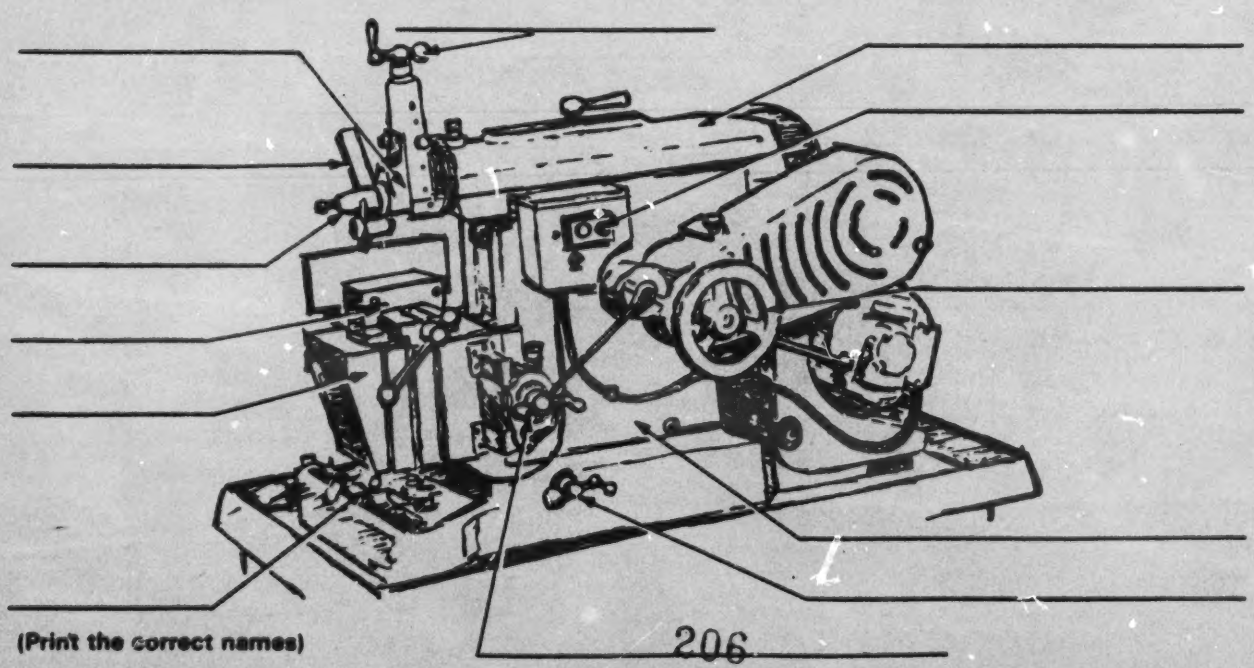
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

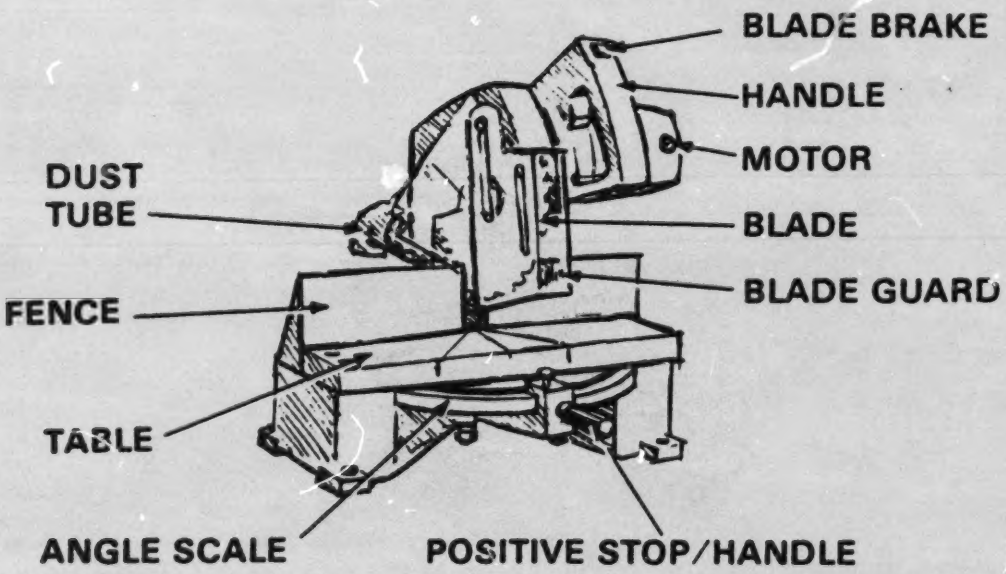
1. It is permissible to stand in front of the machine while it is running. T F
2. Eye protection must be worn. T F
3. A heavy cut may get the job done more quickly but also could be unsafe. T F
4. Chips may be quickly removed while the machine is running. T F
5. All clearances should be checked before the ram is set in motion. T F
6. All set-ups should be approved by your instructor. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Be sure power is disconnected before making angle adjustments or changing blades.
6. Always hold the work firmly against the fence and table.
7. Install a new table if adequate support has been cut away.
8. Allow the motor to reach full speed before starting to cut.
9. Use the brake to stop the blade before removing scrap or chips from the work area.
10. Be sure guard parts are functioning properly.



S

Motorized Miter Box

Name _____

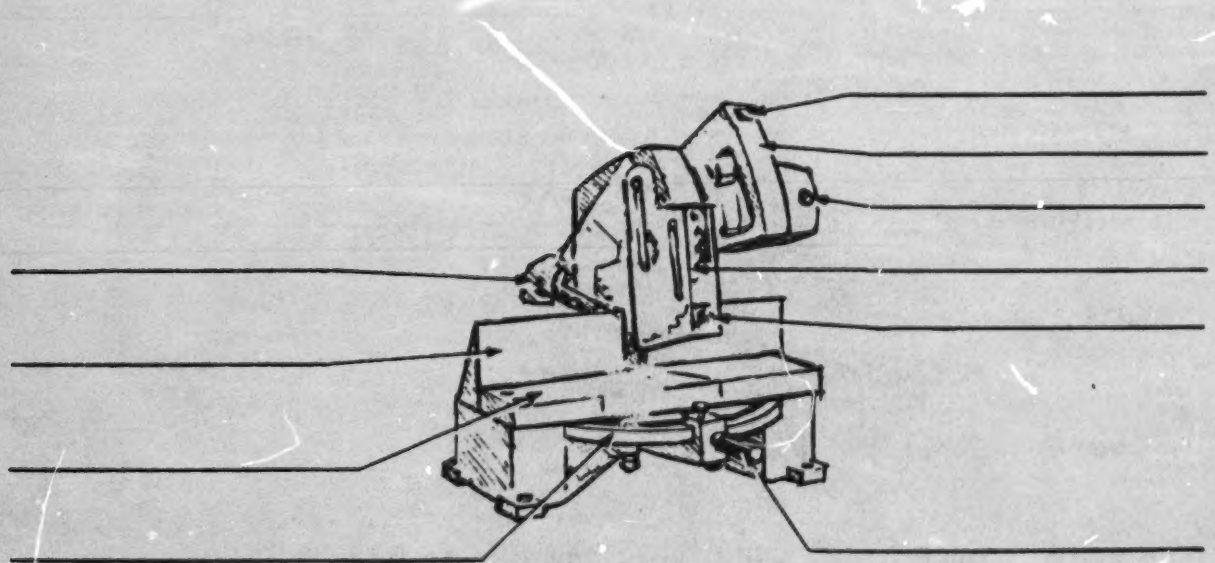
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

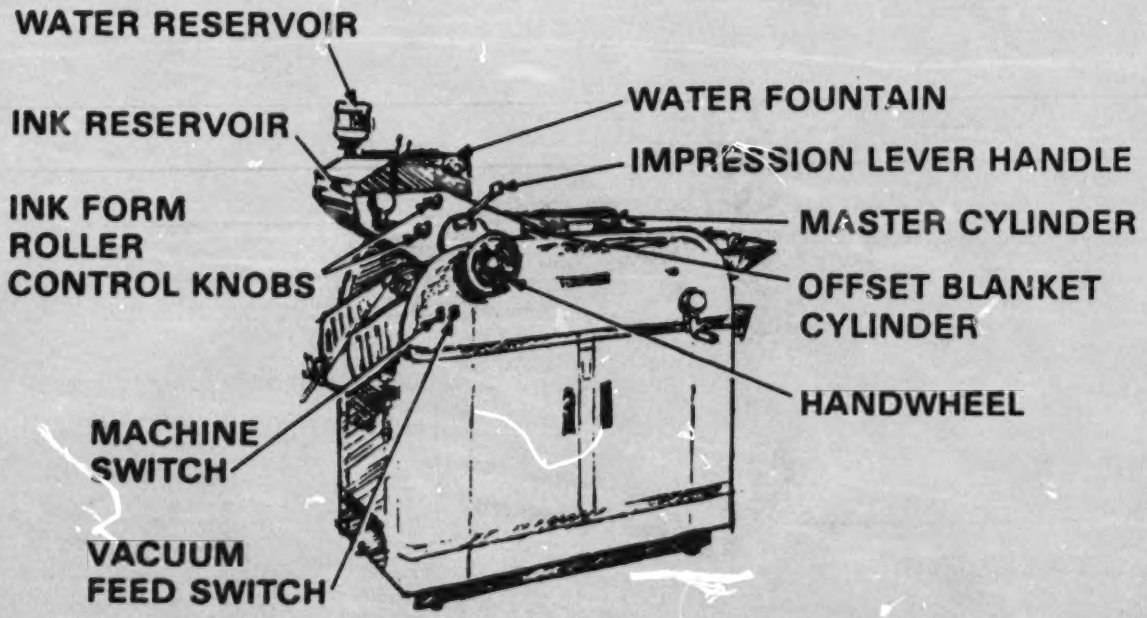
1. The table on this machine can be cut so often that it no longer gives safe support to the work. T F
2. The machine should be stopped by pushing a piece of scrap against the side of the blade. T F
3. The guard sections can easily be checked for proper operation before starting to use the machine. T F
4. The trigger switch and the brake button can be used together to gain better control. T F
5. A warped or twisted work piece is not really dangerous. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Never reach for misprinted or dropped paper while the press is in operation.
6. Do not make internal adjustments while the press is in operation.
7. Do not clean the press while it is in operation.
8. The instructor should determine the operating speed.
9. Never reach across the press while it is in operation.
10. When finished with the press, it must be clean and all paper, equipment and tools must be returned to proper storage.



S **Offset Printing Press**

Name _____

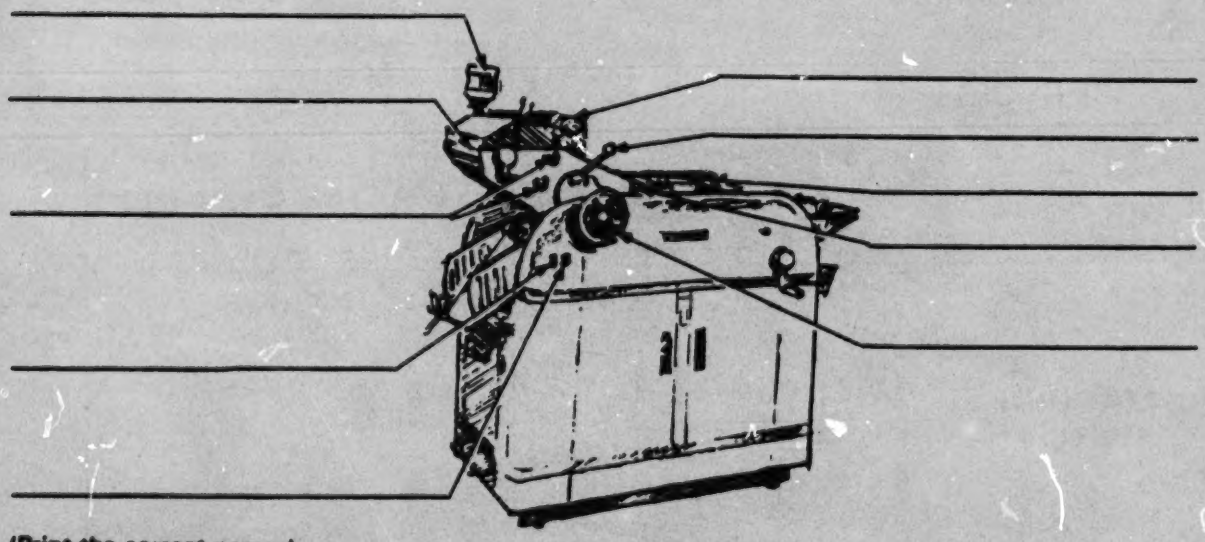
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

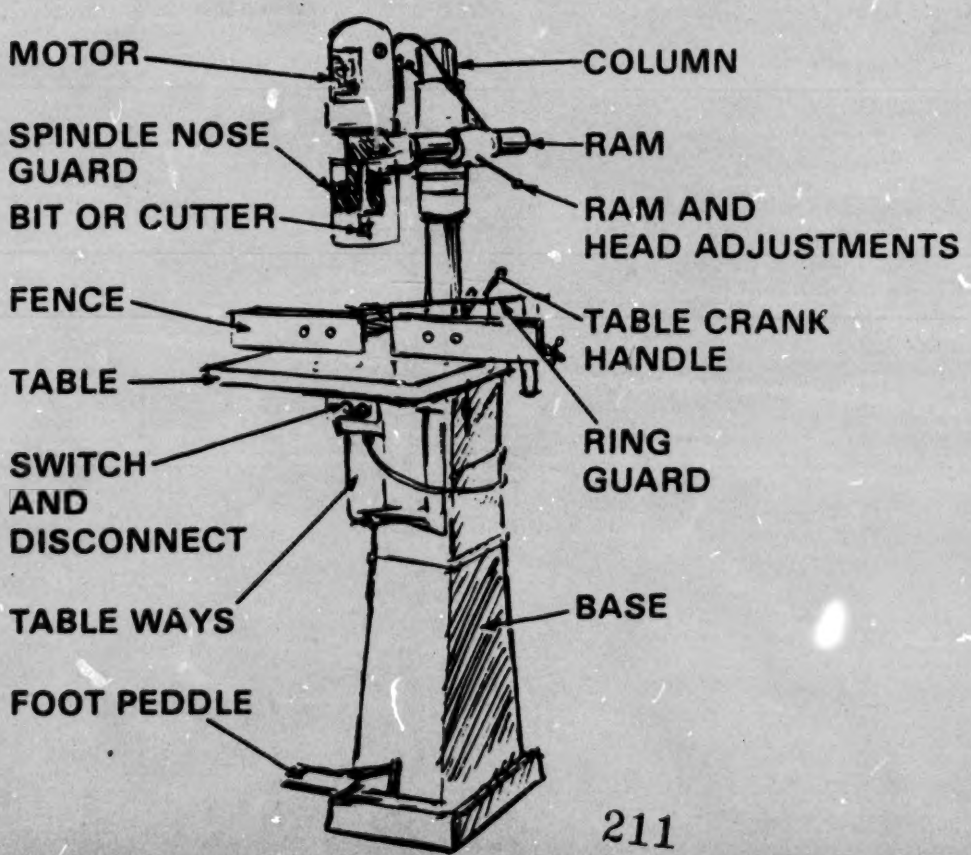
1. The gears need not be covered while the press is in operation. T F
2. The machine must be stopped before misprinted or dropped paper is removed from the press. T F
3. Final adjustments may be made while the machine is running. T F
4. You should be alert to keeping others away from the press while it is in operation. T F
5. It is safe to reach across the press when it is operating. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make all adjustments to the table, fence, overarm and spindle with the power turned off.
6. Disconnect from power source when changing cutters or bits.
7. Check set up carefully before starting operation to be sure cutter clears the table, fence and any fixtures.
8. Be sure guard is in place before starting cut.
9. Feed material against the direction of rotation when ever possible.
10. When pin routing make sure pin or table insert is tight and the work piece is secure in the jig.



Overarm Router

S _____

Name _____

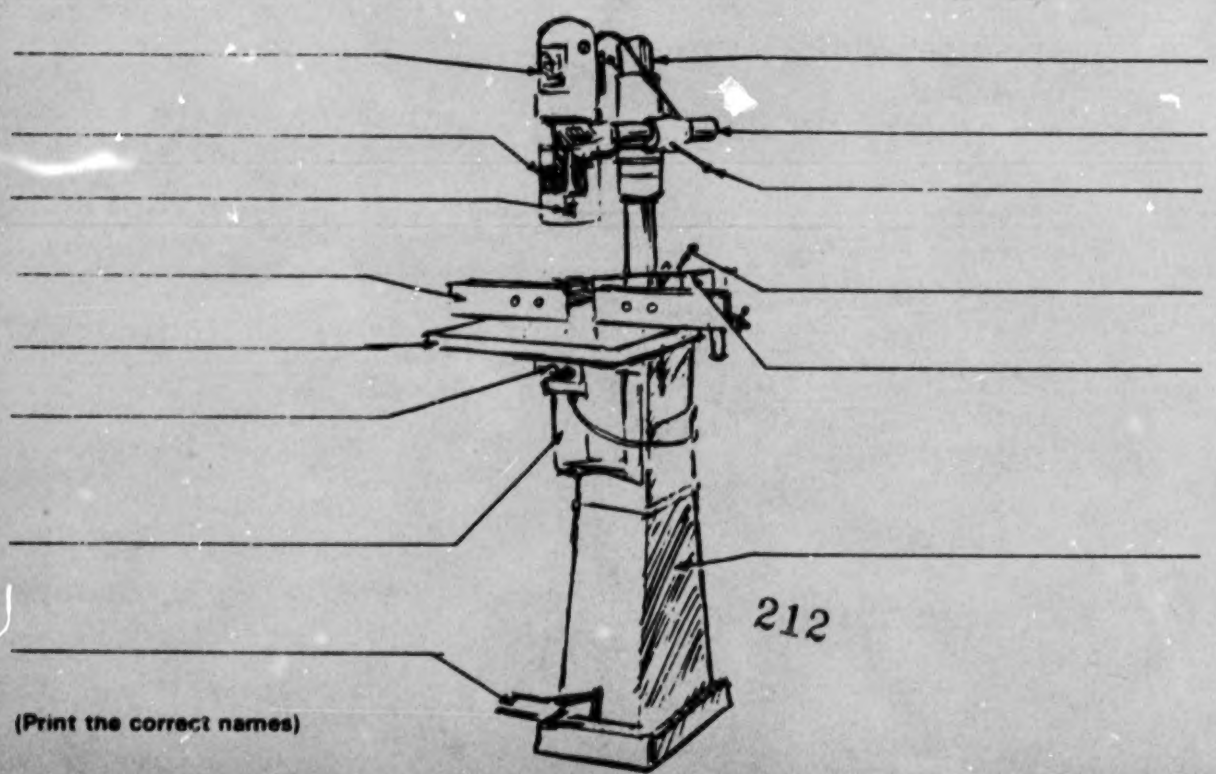
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. When shaping or routing a jogging motion will give a smoother cut. T F
2. Special or custom jigs or fixtures are necessary for some operations. T F
3. The machine must be disconnected from the power source when changing bits. T F
4. The speed of this machine is about 5 thousand RPM. T F
5. Both hands should be used to more or control the work piece. T F



212

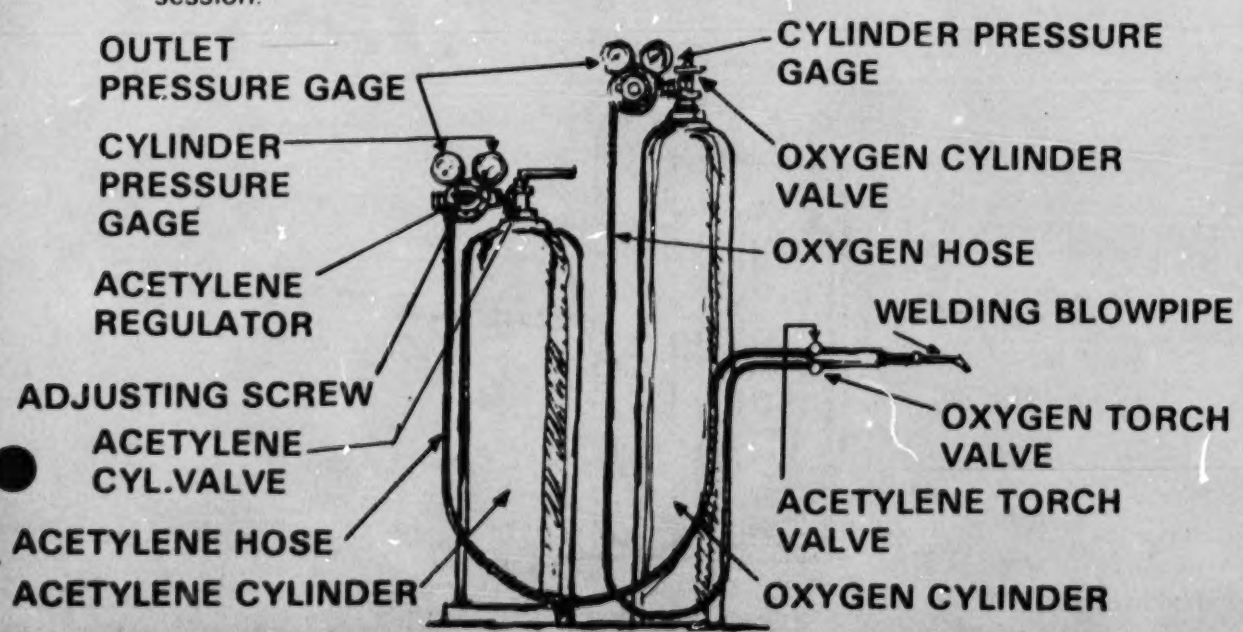
(Print the correct names)

Oxy-Acetylene Welder

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**

1. Do not allow oil to come in contact with hoses or equipment.
2. Gas bottles must be erect and secure at all times.
3. Keep the cylinder caps on the bottles when not in use.
4. Protective goggles and spark-resistant clothing must be worn when welding.
5. Confine all cutting and welding to the designated area in the shop.
6. Do not weld galvanized metal without proper ventilation.
7. Do not weld or cut on a closed container without instructor's approval.
8. The acetylene must never exceed 15 psi outlet pressure.
9. Turn off torch valves when finished with equipment.
10. Turn off gas and oxygen at tanks or stations at the end of class session.



S

Name _____

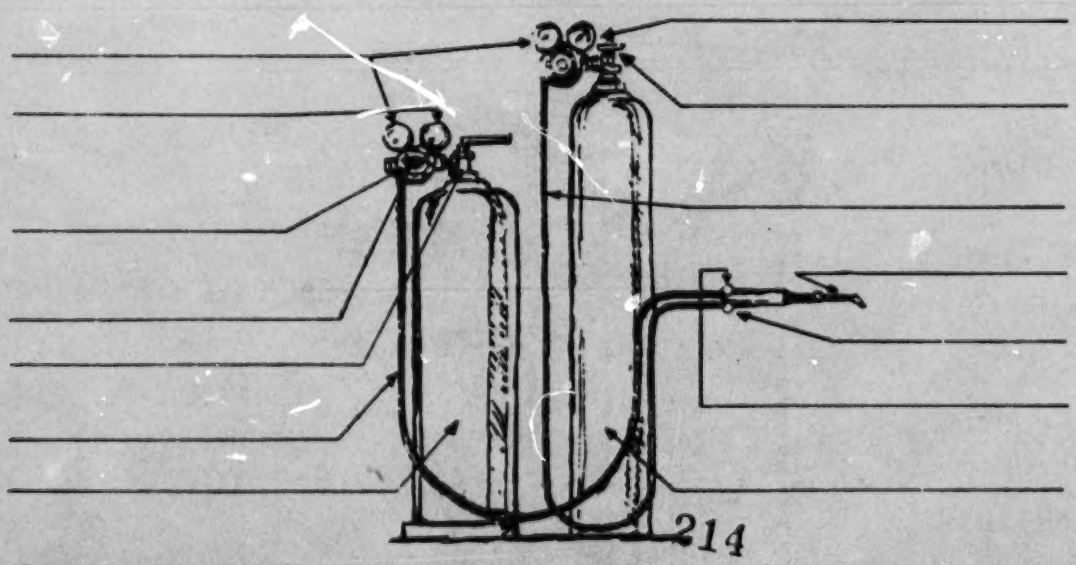
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. Gas bottles may be laid on the floor when not in use. T F
2. Closed containers are not hazardous to weld or repair. T F
3. The cylinder caps should be placed on all bottles when not in use. T F
4. Eye protection must be worn for all welding, cutting and chipping operations. T F
5. The equipment should not be wiped down with oily rags. T F
6. Acetylene pressure should be set at 20 psi. T F



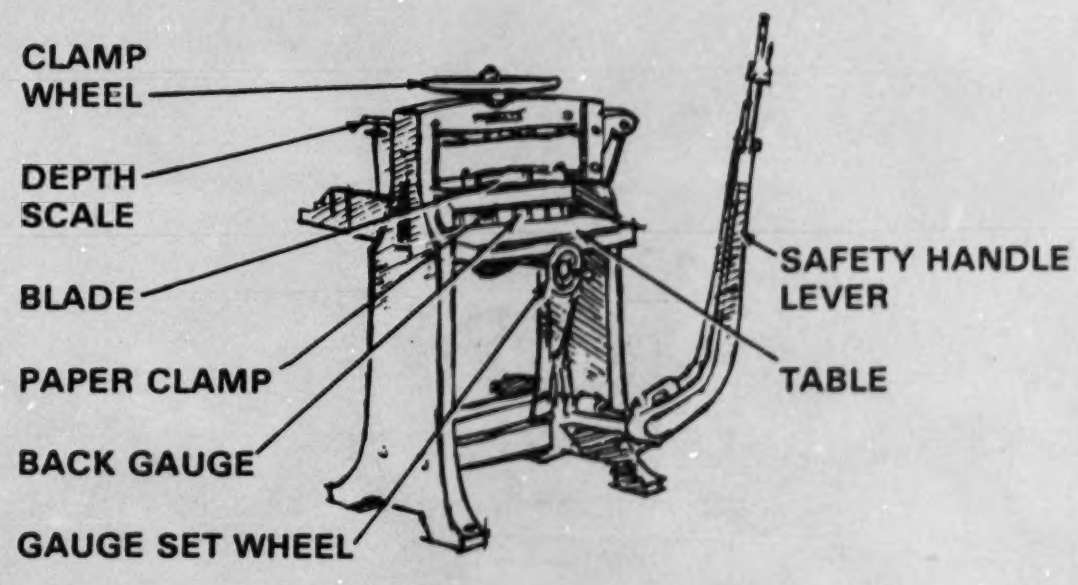
214

(Print the correct names)

Paper Cutter

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Changing or adjusting of the knife must be done by the instructor only.
6. All items other than the paper to be cut must be kept off the tables.
7. Both hands must be kept on the controls during the complete clamping and cutting cycle.
8. Floor area around the machine and controls must be clear of trimmings.
9. All adjustment of the machine, positive stops or guides must be made with the power off.



S

Paper Cutter

Name _____

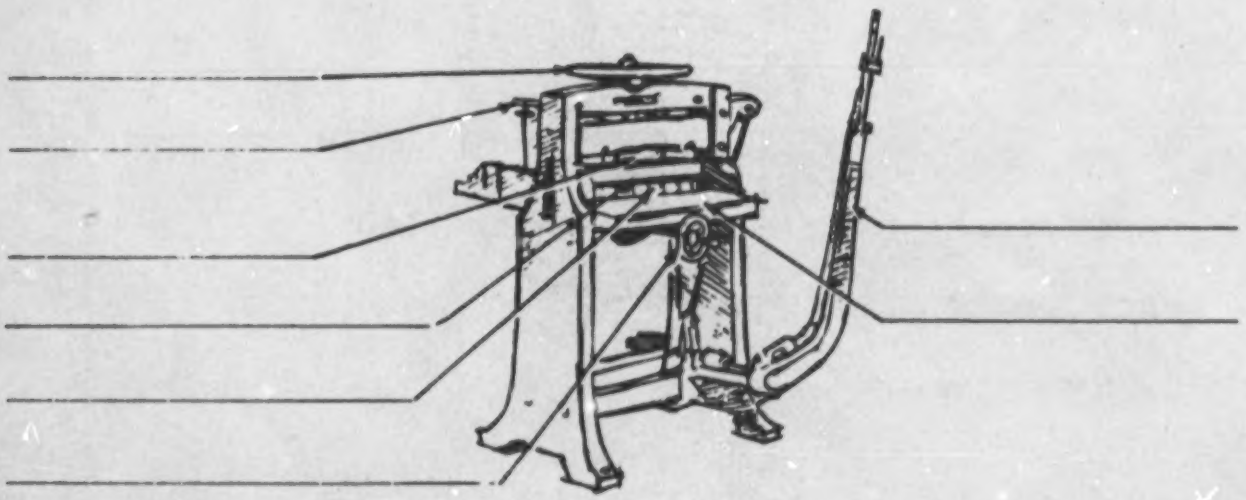
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

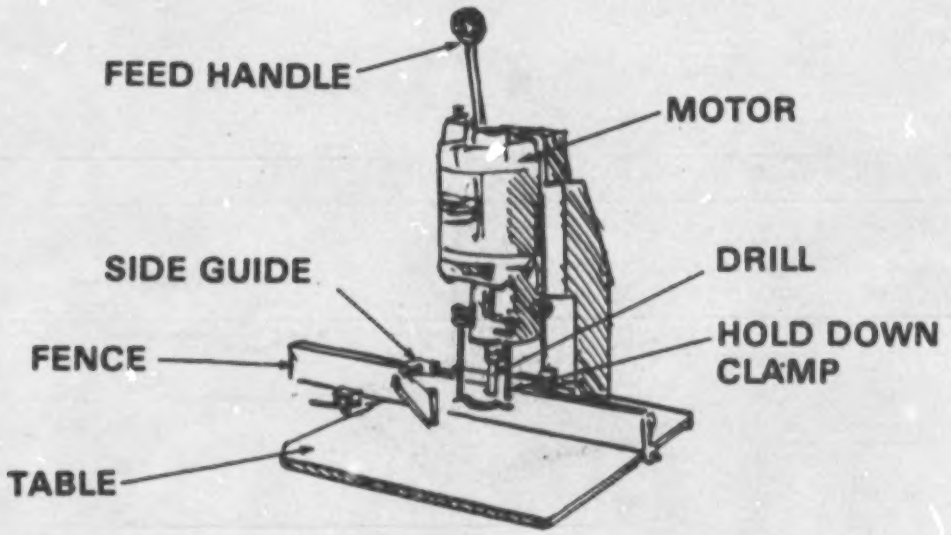
1. Since there are no chips involved, safety glasses are not required to operate this machine. T F
2. The floor must be kept clean around the paper cutter. T F
3. It is alright to cut thin gage metal on this machine. T F
4. Stops or gages should be adjusted only when the machine is turned off. T F
5. Hands should always be kept clear of the clamp and the cutter. T F



(Print the correct names)

For Safety —

1. Operate only with instructors permission and after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. Be sure power is disconnected when making adjustment.
6. Keep hands clear of drilling area.
7. Be sure only one individual operates the unit.
8. Never touch the drill immediately following the drilling operation since it could be hot.



S

Paper Drill

Name _____

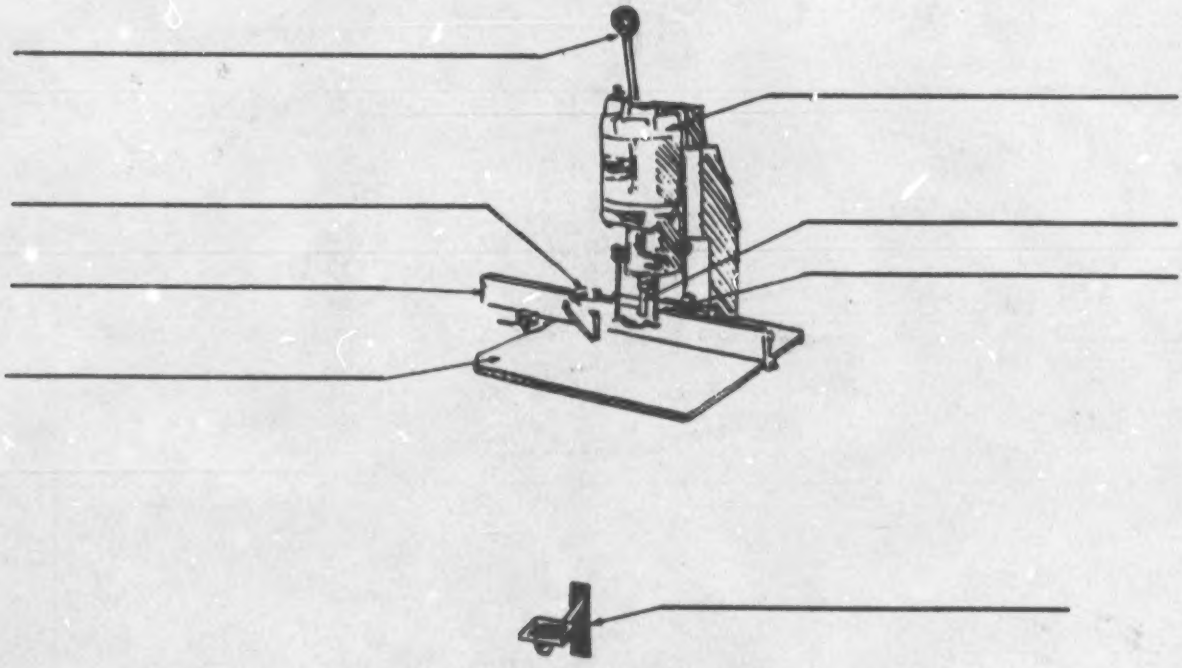
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

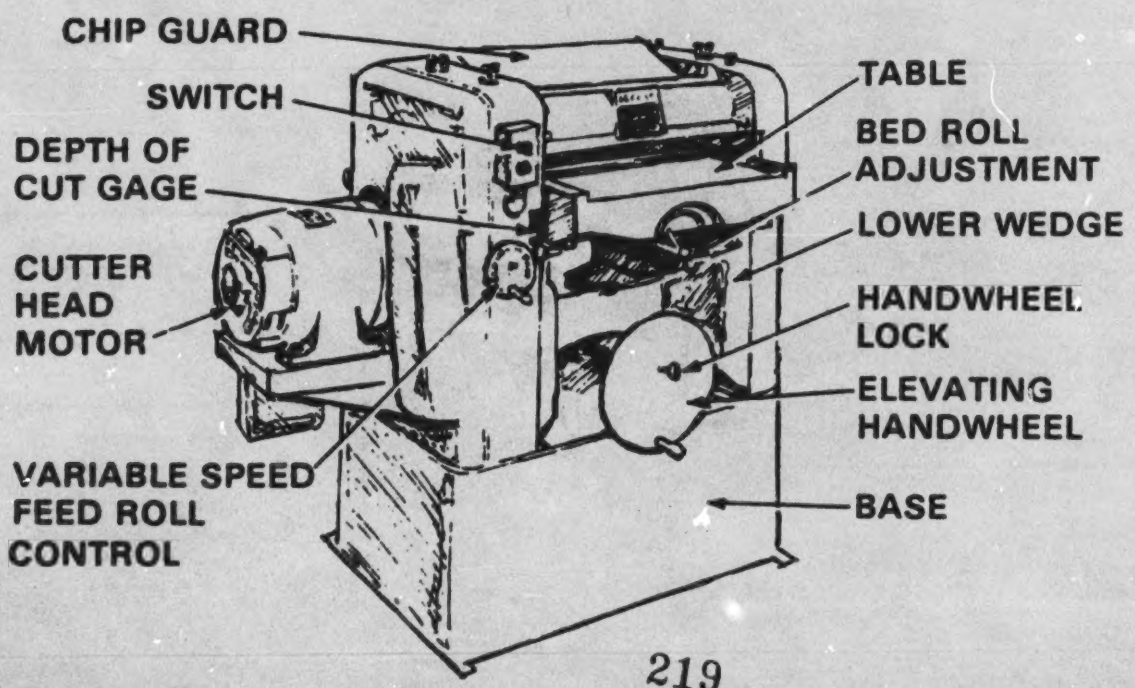
1. Guides or positive stops can be adjusted while the drill running. T F
2. When drilling paper the drill bit does not get hot. T F
3. Only one person should opeate the unit at one time. T F
4. Hands must be kept clear of the hold down and drilling area. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Be sure to check all material for loose knots, nails and other foreign objects.
6. Do not force stock through the planer. Keep hands off the material & let the power feed operate.
7. Select the proper depth of cut and the rate of speed depending on the stock being planed.
8. Thin stock should be properly supported by a jig or back up board. Check with the instructor for minimum thickness and length.
9. Never look directly into the throat of a planer at table level while it is running or in operation.
10. Remove shavings or chips when the power is turned off. Keep hands away from chip guard and the point of operation.
11. Do not stand directly in front of the machine in line of possible kick back.



S

Planer-Surfacer

Name _____

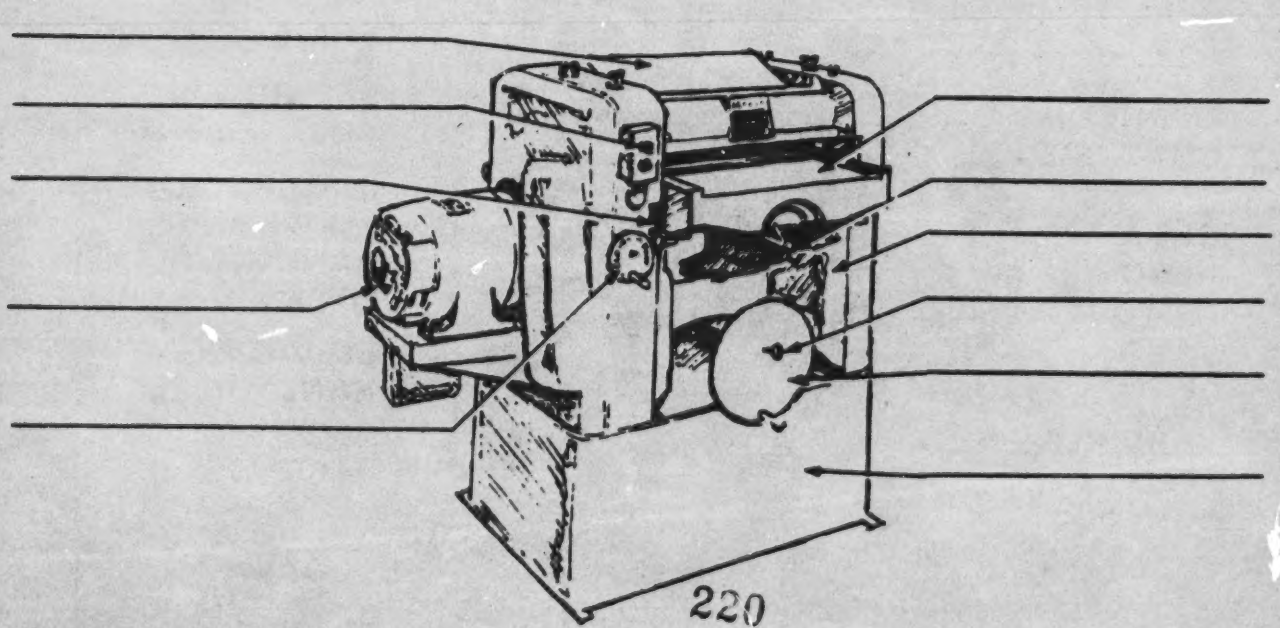
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. There is no real minimum regarding thickness or length of stock which can be planed safely. T F
2. Stock should be pulled through the planer by hand. T F
3. You should never look into the throat area at table level. T F
4. The power should be turned off while removing chips or shavings. T F
5. A jig or other support is often needed for thin stock. T F
6. The proper depth of cut and rate of speed is related to the material being planed. T F

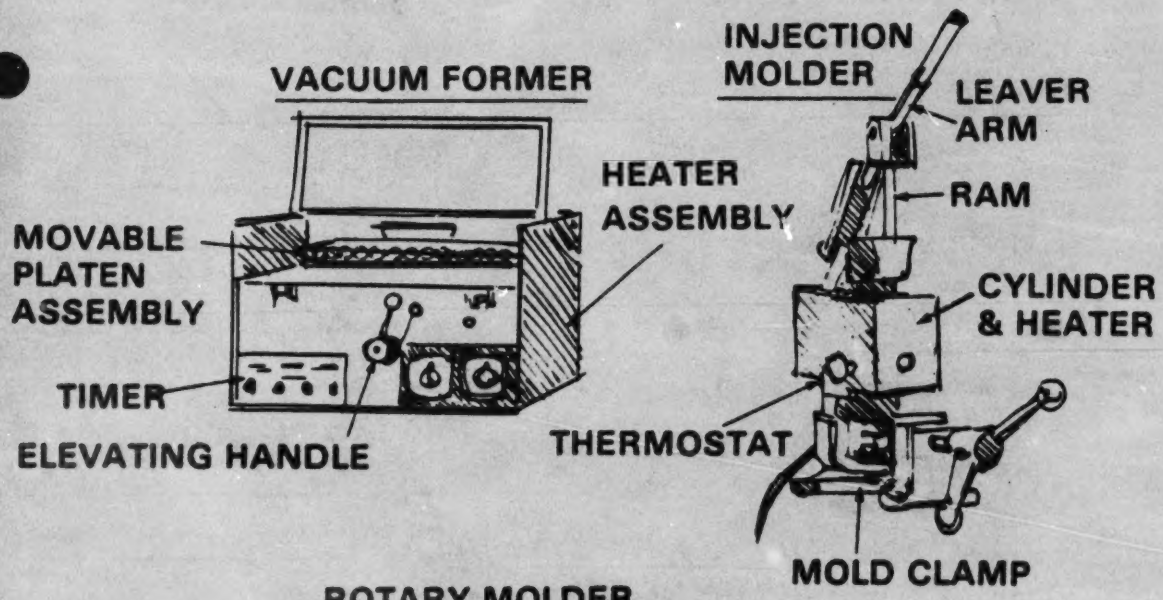


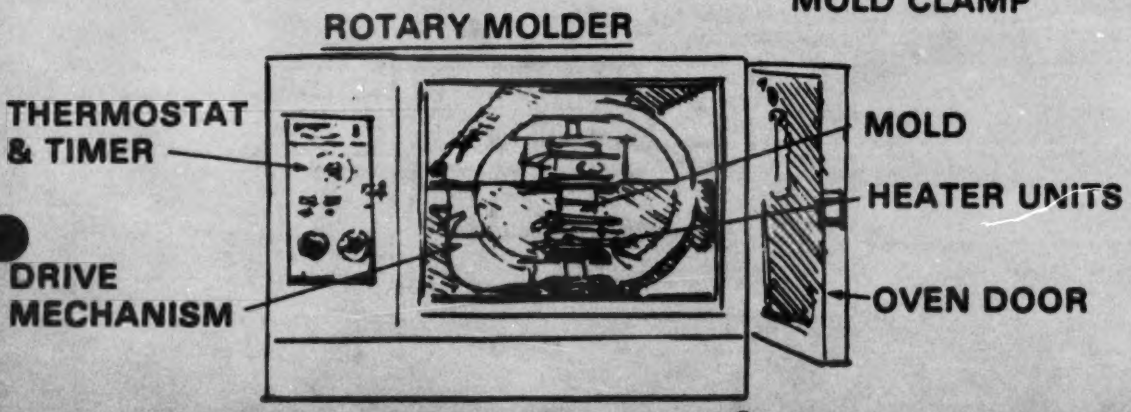
220

(Print the correct names)

For Safety —

1. Operate only with instructors permission and after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. All three of these machines operates with heating units — use with caution.
6. Do not over heat — match heat/timecycle with material being used.
7. Observe and stay clear of pinch points.
8. Do not over pressure Injection Molder Ran.





S _____

Name _____

Class _____

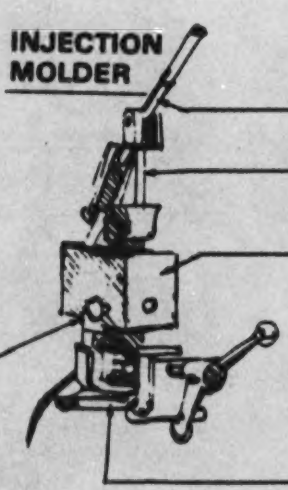
Date _____ Grade _____

Safety Quiz

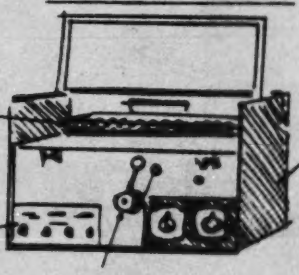
(Circle True or False)

1. The injection molder can not be over pressurized. T F
2. The heat and time cycle should be matched with the type of material. T F
3. There are no pinch points on this type of equipment. T F
4. The work piece is usually too hot to touch with bare hands when formed or completed. T F

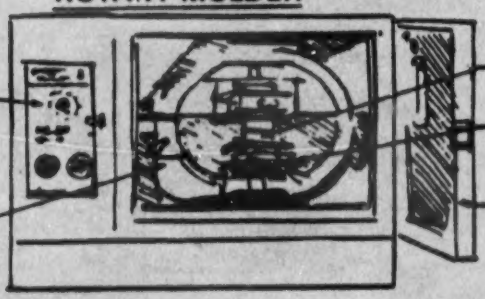
INJECTION MOLDER



VACUUM FORMER



ROTARY MOLDER

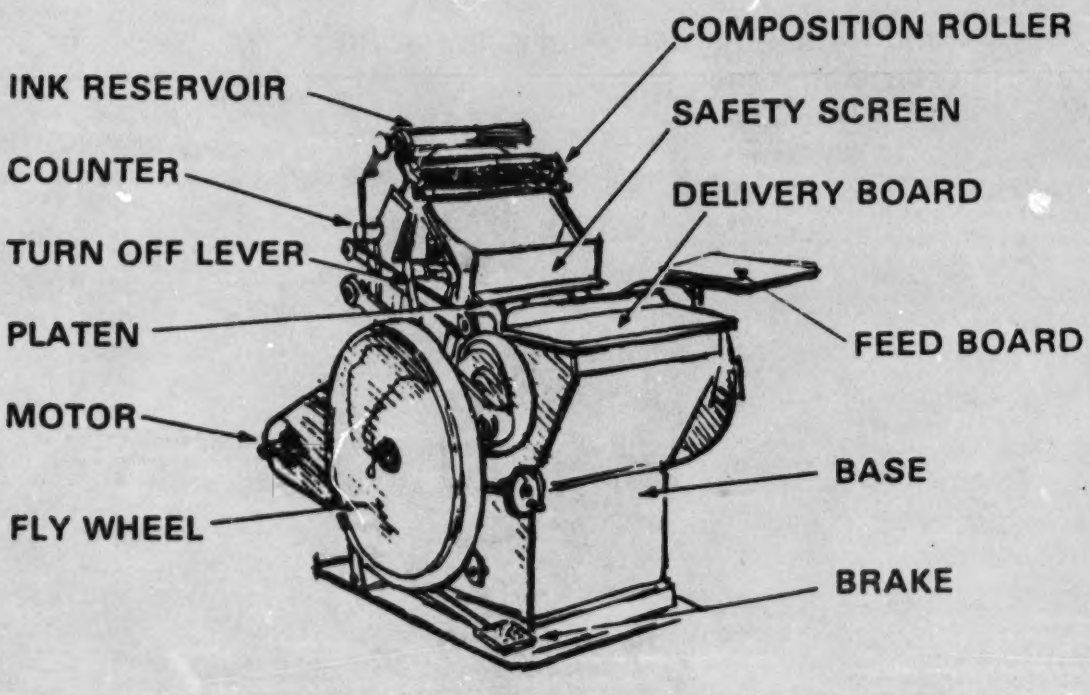


(Print the correct names)

Platen Printing Press

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Operate the press at a speed that matches your ability to feed the paper.
6. Apply ink to the ink plate prior to starting the press.
7. Make sure the grippers are not in the way of the type form.
8. Only one operator at the press at a time.
9. Keep your hands out of the press when creating an impression.



Platen Printing Press

S

Name _____

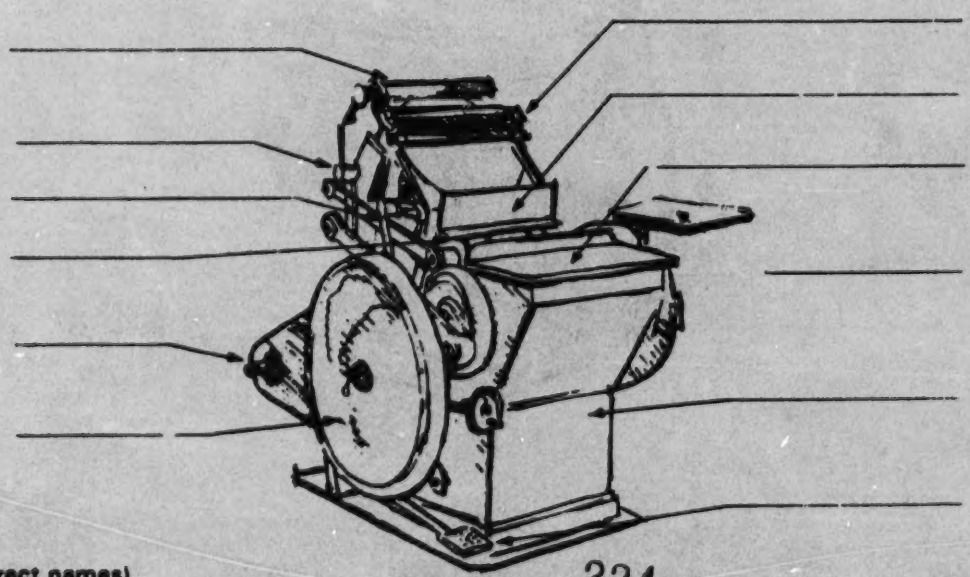
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. Operate the press at a speed that is safe for your ability level. T F
2. Loose clothing or hair must be confined. T F
3. The position of the grippers is not important. T F
4. The ink plate may be inked while the press is in operation. T F
5. Three or four people can sucessfully operate the platen press at the same time. T F

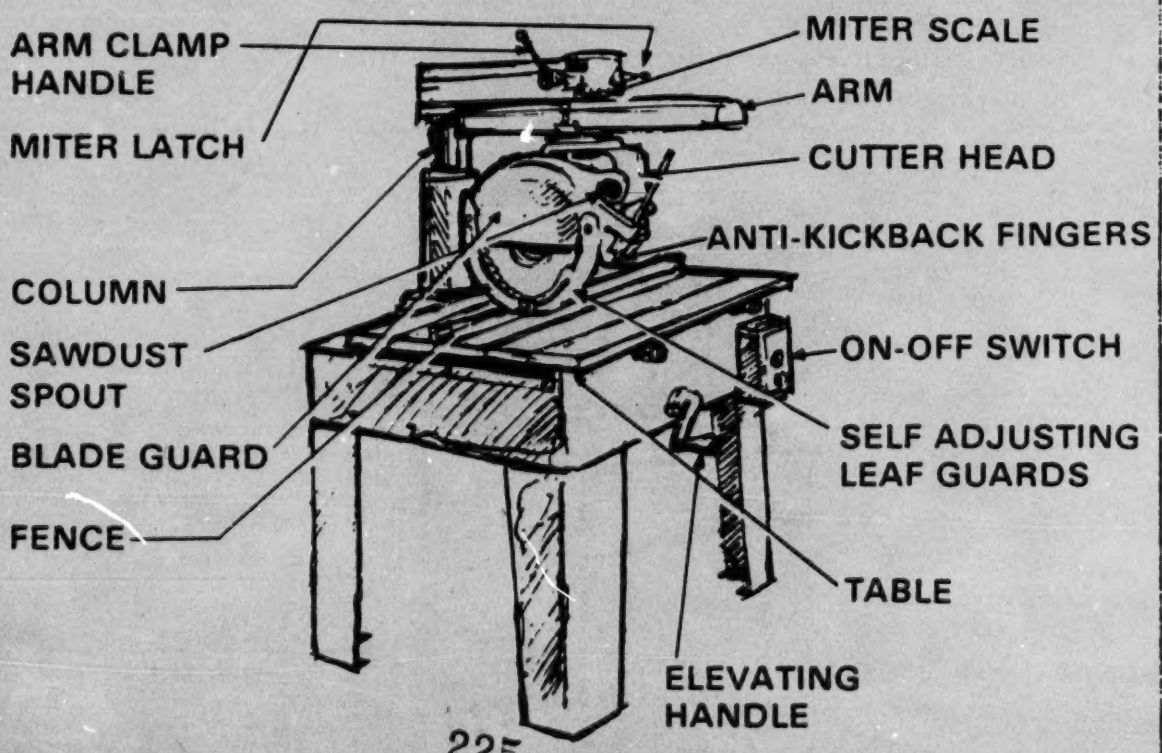


(Print the correct names)

Radial Arm Saw

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make all adjustments with the power off.
6. Be sure the leaf guards are operating properly and the blade will not extend beyond the table edge.
7. When cross cutting hold the material securely against the fence.
8. Always pull the blade through the work and return the cutter head behind the fence before removing material or starting the next cut.
9. Make sure the blade guard and kickback fingers are properly adjusted before ripping.
10. Always rip into the blade, never in the same direction as the rotation.
11. Make sure the blade has stopped before leaving the machine.



S

Radial Arm Saw

Name _____

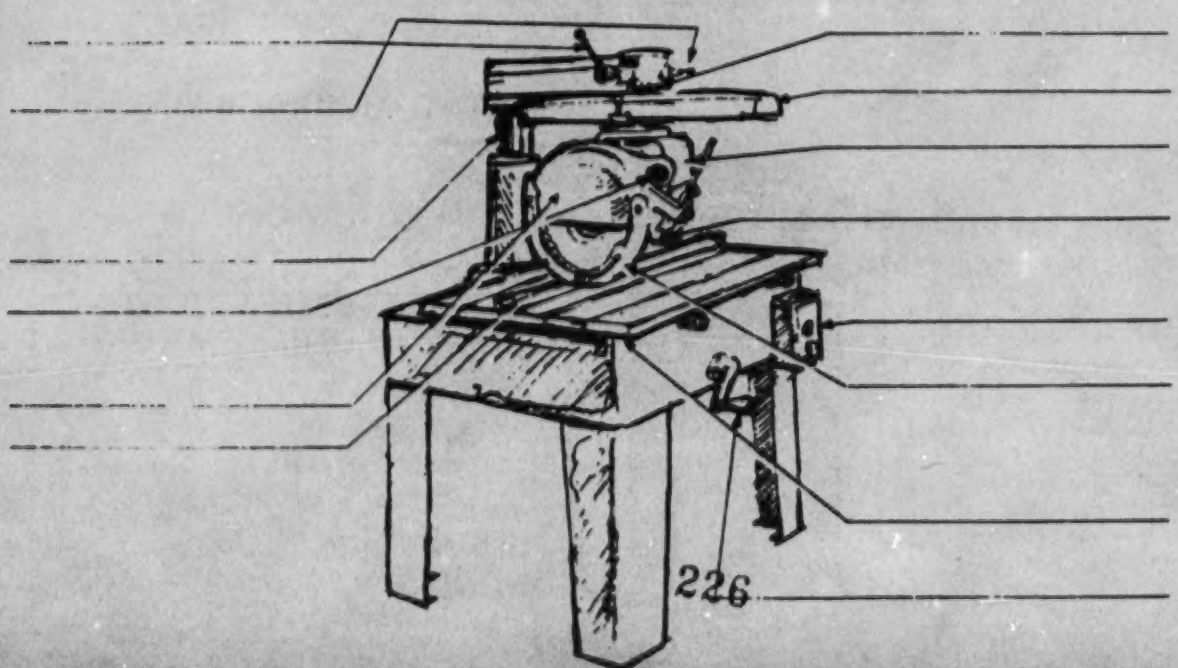
Class _____

Date _____ Grade _____

Safety Quiz

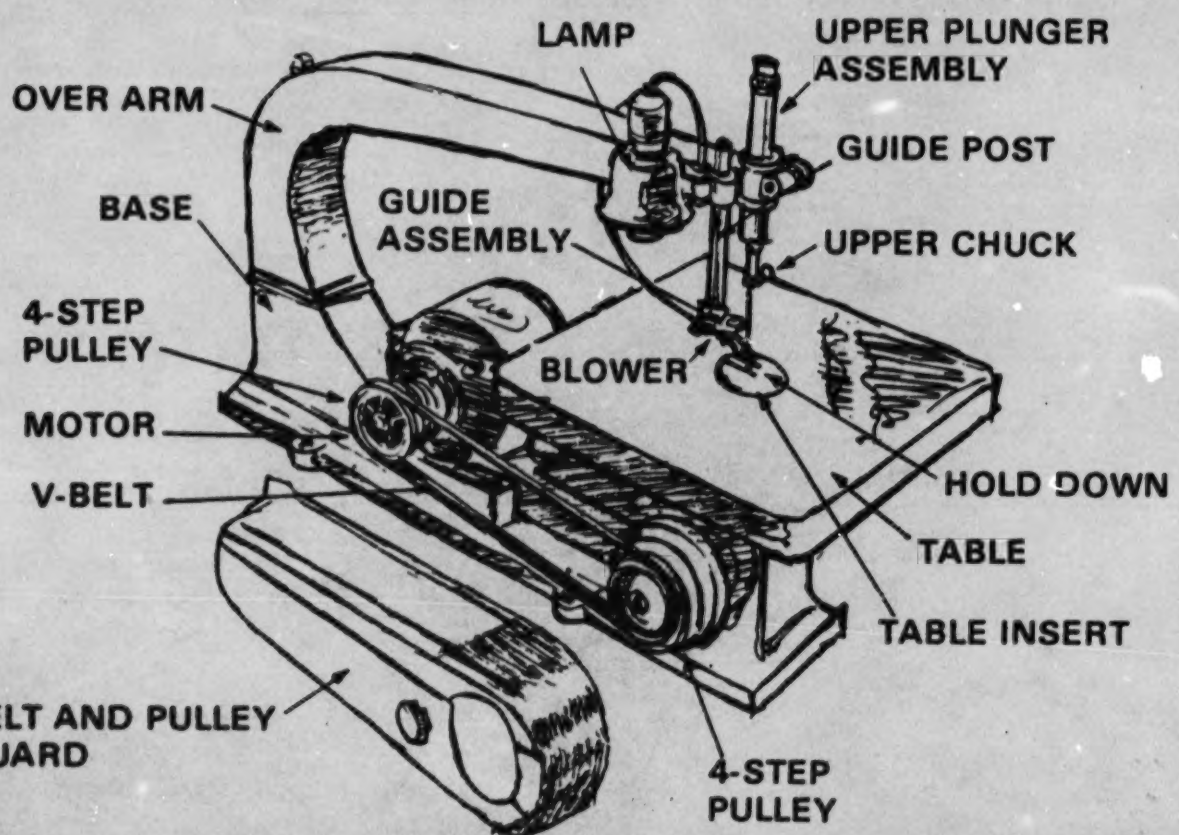
(Circle True or False)

1. Eye protection is not necessary except when ripping. T F
2. The guard and kickback fingers must be in place when ripping. T F
3. The saw blade may safely extend beyond the table. T F
4. The blade should be installed so that in cross cut position the teeth at the bottom of the blade point away from the operator. T F
5. When ripping, one hand must hold the material and the other hand operate the saw. T F
6. In cross cutting, the saw should be returned to the rear of the arm upon the completion of each cut. T F



For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make all adjustments with the power off, then rotate the motor by hand as a final check.
6. Be sure hold down is pressing lightly on the work piece.
7. The blade should be held firmly in the chucks, be square with the table, and be properly supported by the guide assembly.
8. Guide the material slowly through the machine with both hands, keeping fingers away from the cut line.
9. Choose the correct blade and correct speed for the material to be cut, and for the smallest radius required.



S

Scroll Saw

Name _____

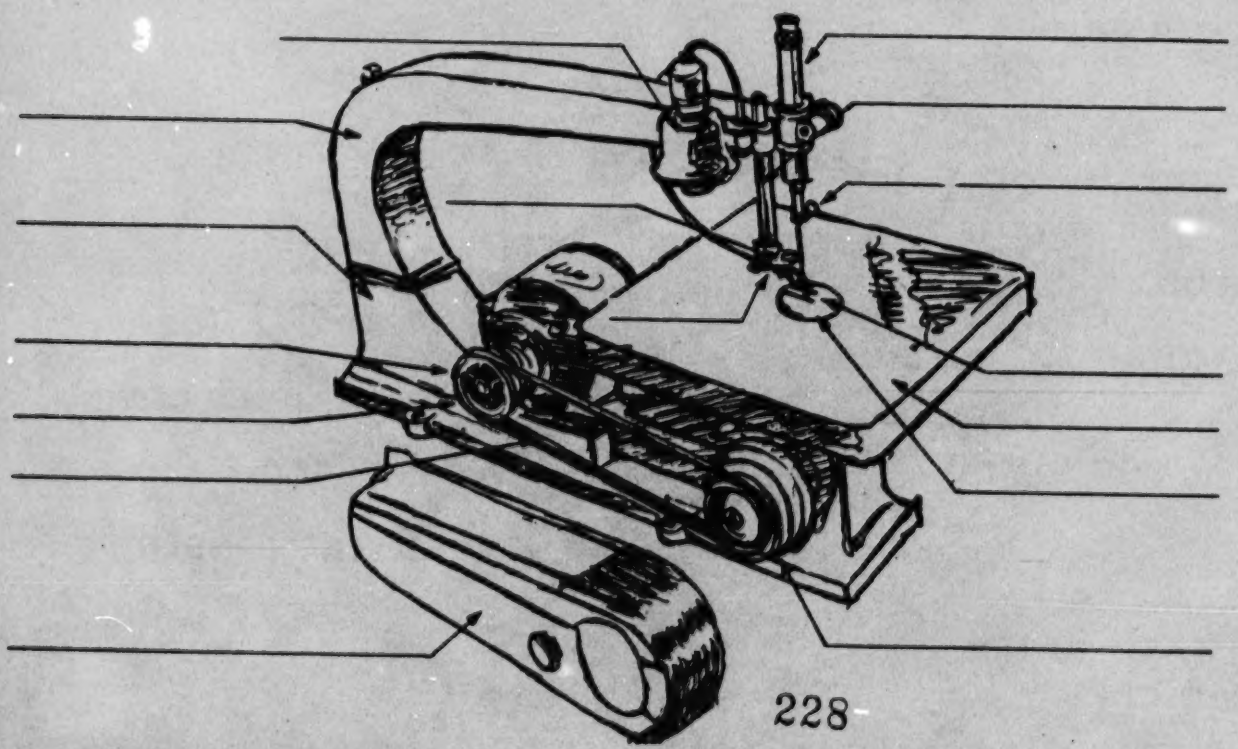
Class _____

Date _____ Grade _____

Safety Quiz

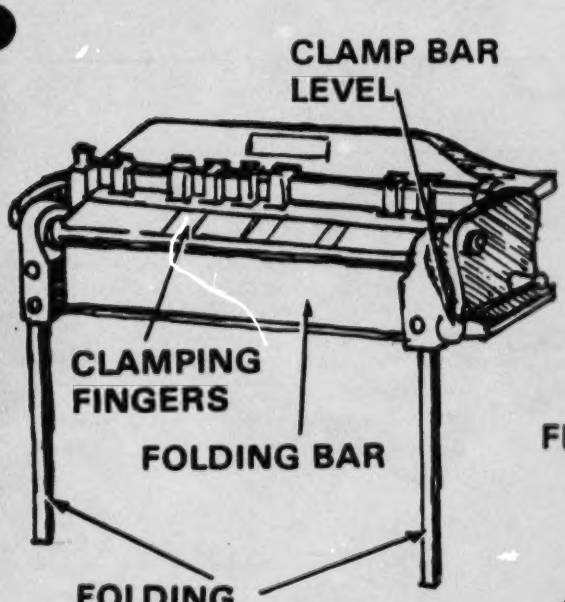
(Circle True or False)

1. If the blade pinches in the kerf you should just push harder. T F
2. It is necessary to have the flat side of the stock tight against the table. T F
3. Fingers should be kept away from the cutting line. T F
4. The hold down should be 1/16" from the work piece. T F
5. After changing blades or making guide adjustments the machine should be rotated one full stroke by hand. T F

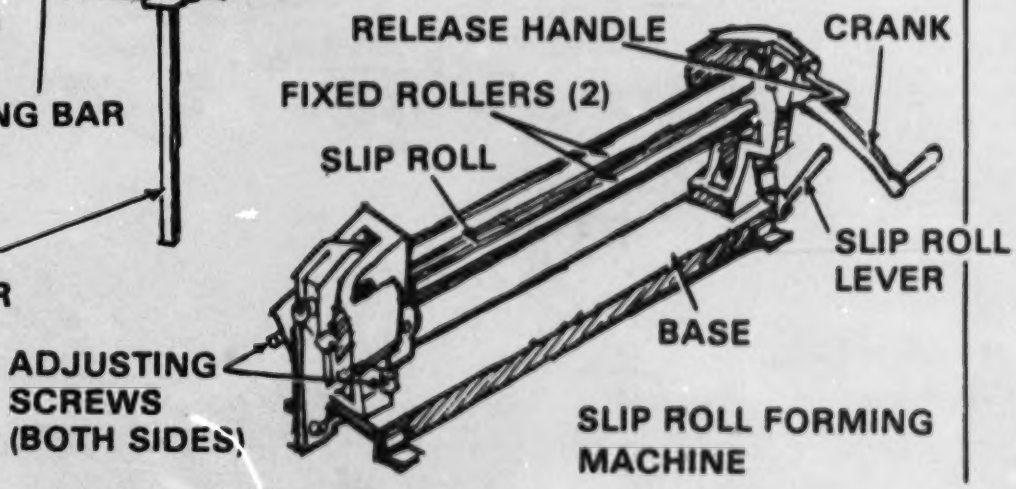


For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Adjust, change rolls, set stops, and properly check or assemble before operating.
6. Never bend, roll, crimp or bead metal which exceeds the capacity of the machine.
7. Work with only one piece of metal at one time, never double thickness or two pieces side by side.
8. Remove burrs from the metal before attempting to work it in the machine.
9. Keep hands away from clamps, jaws, rolls and other pinch points.
10. Do not force hit or drop-levers or handles.



ROTARY MACHINE



SLIP ROLL FORMING MACHINE

S

Sheet Metal Machines

Name _____

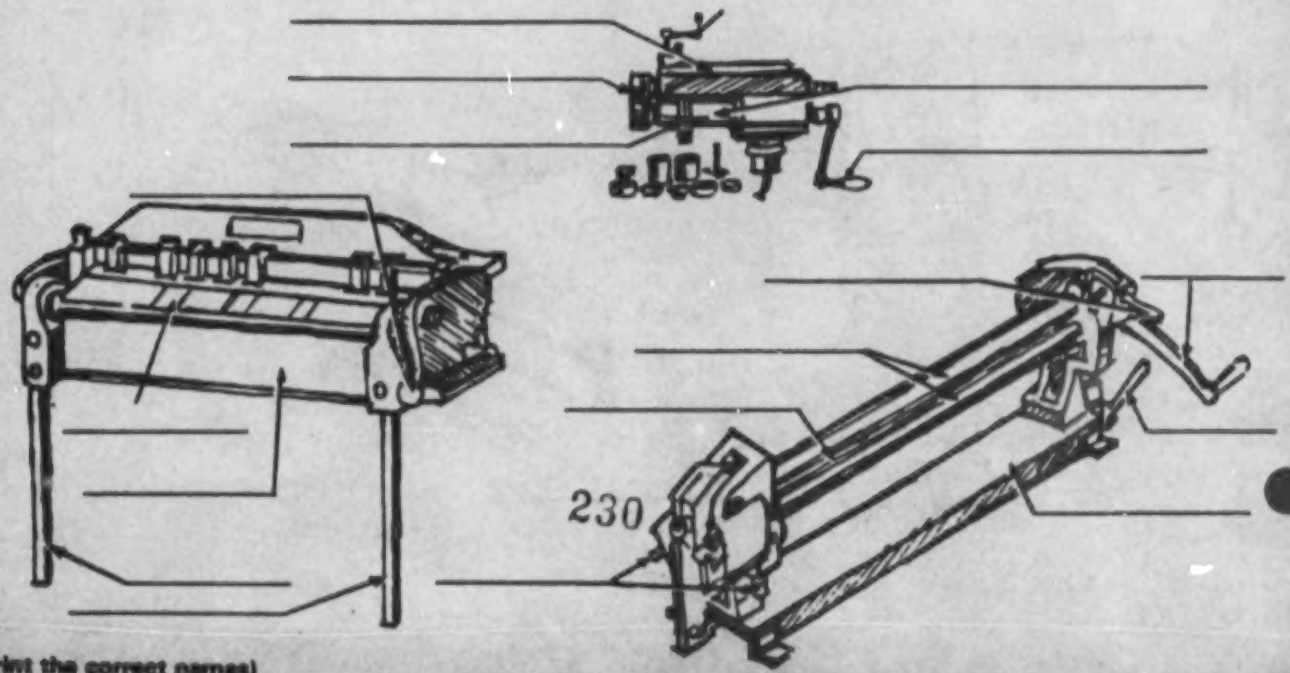
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. The infeed rolls of a roll machine are dangerous to the operator's hands. T F
2. Sheet metal machines can be damaged by overloading. T F
3. Sharp burrs and edges should be removed before attempting to place in the machine. T F
4. Fingers must be kept clear of moving parts. T F
5. Quarter inch mild steel stock can be formed on the sheet metal machine. T F
6. If a handle jams it can be tapped lightly with a hammer. T F

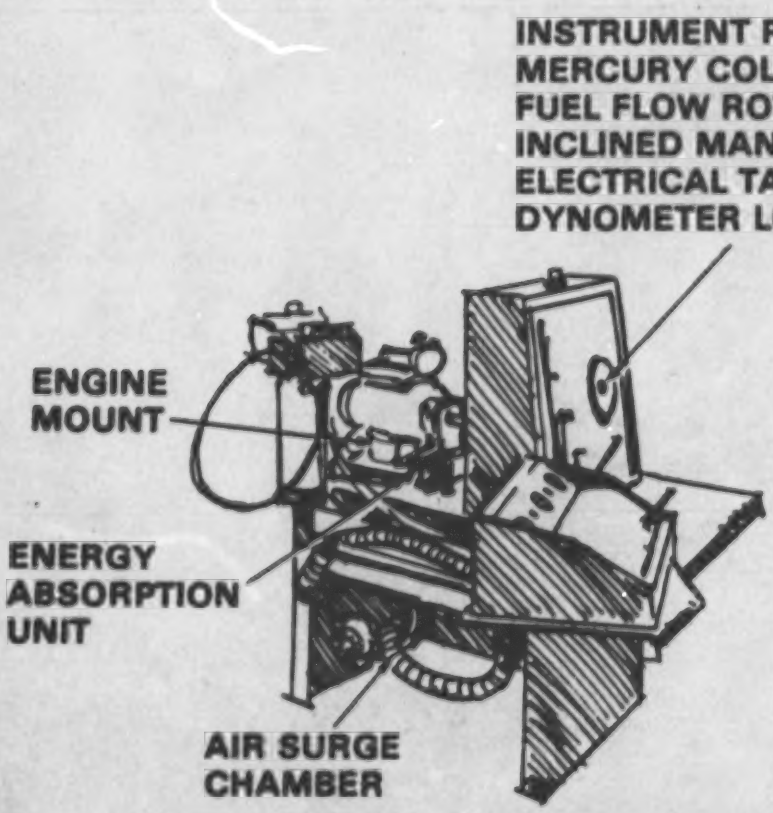


(Print the correct names)

Small Engine Analyzer

For Safety —

1. Operate only with instructors permission and after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. Utilize unit only with proper exhaust ventilation system.
6. Exercise caution when handling fuel, filling fuel tank, wipe up all spillage. Inspect fuel system frequently for defects.
8. Make sure all engines have proper lubrication and are mounted securly.
9. Utilize caution while operating and after opeation, because engine will be hot.



S

Small Engine Analyzer

Name _____

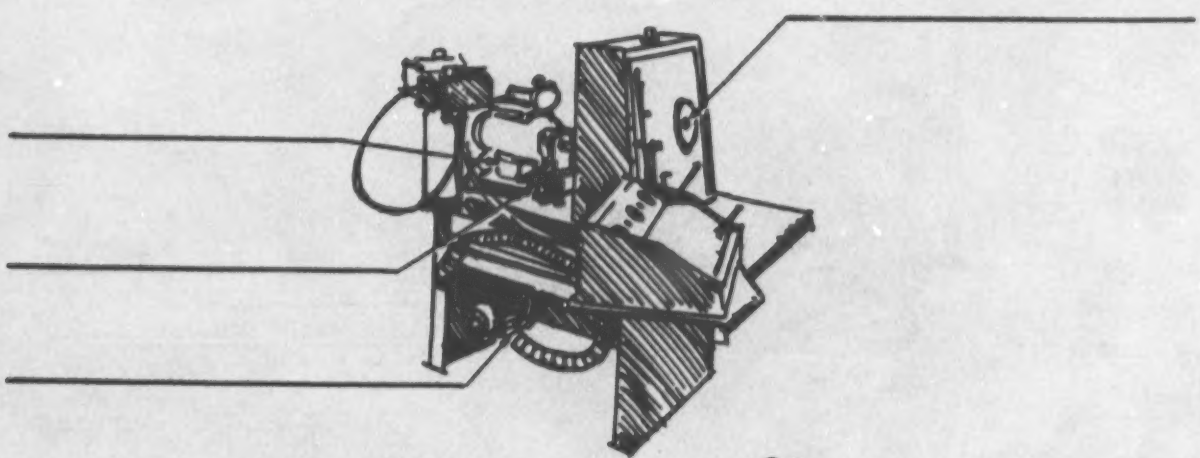
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. After testing the engine is usually too hot to touch. T F
2. The oil level in the engine should be checked before testing. T F
3. Since the engine runs only a short time exhaust ventilation is not critical. T F
4. Small amounts of spilled fuel are not really hazardous. T F
5. The engine must be mounted securely. T F

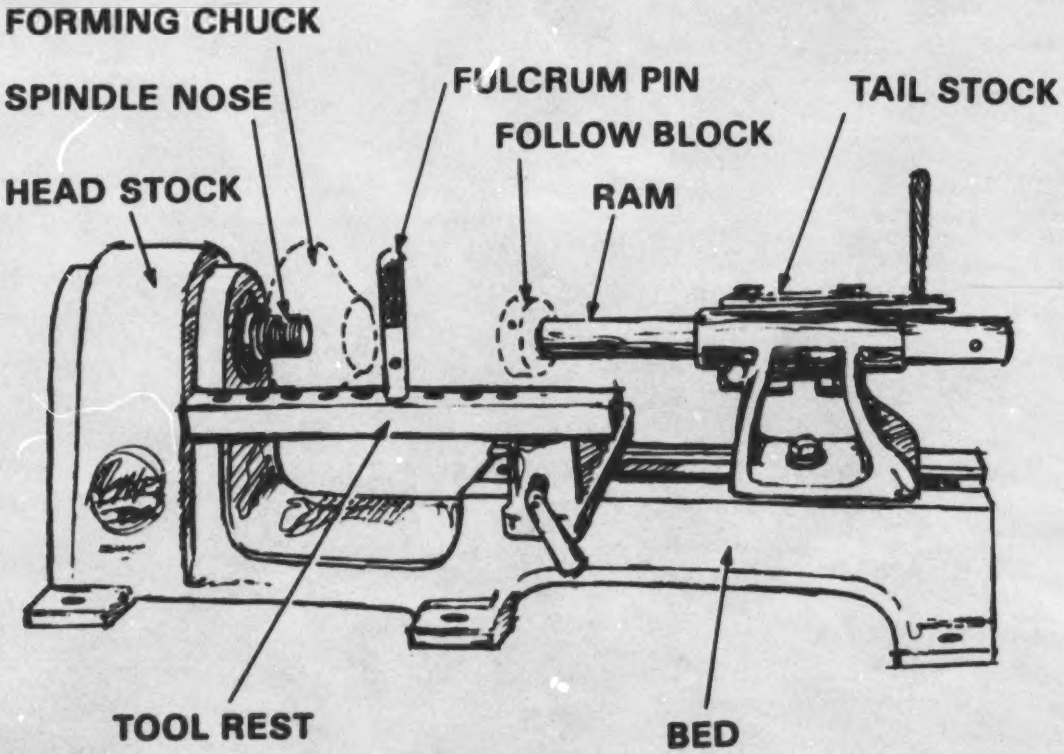


232

(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Be sure and stand clear of the spindle nose in front of the spinning lathe.
6. Do not touch a spinning disc with your hand.
7. The tool rest should be no farther than 1" away from the disc.
8. Tool rest base, tool rest and fulcrum pin must be tight and secure.
9. Use the correct tool for the operation and slowly force material to match the forming chuck.
10. Remove tool rest and pin when using steel wool or polishing.



Spinning Lathe

S

Name _____

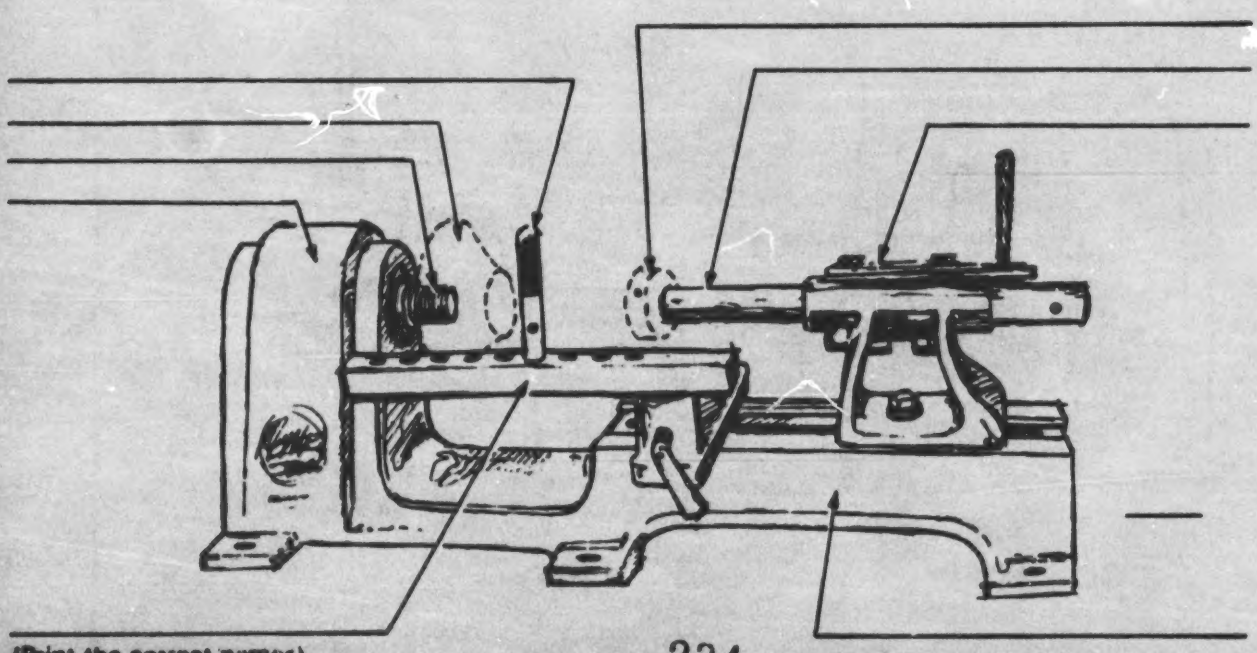
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

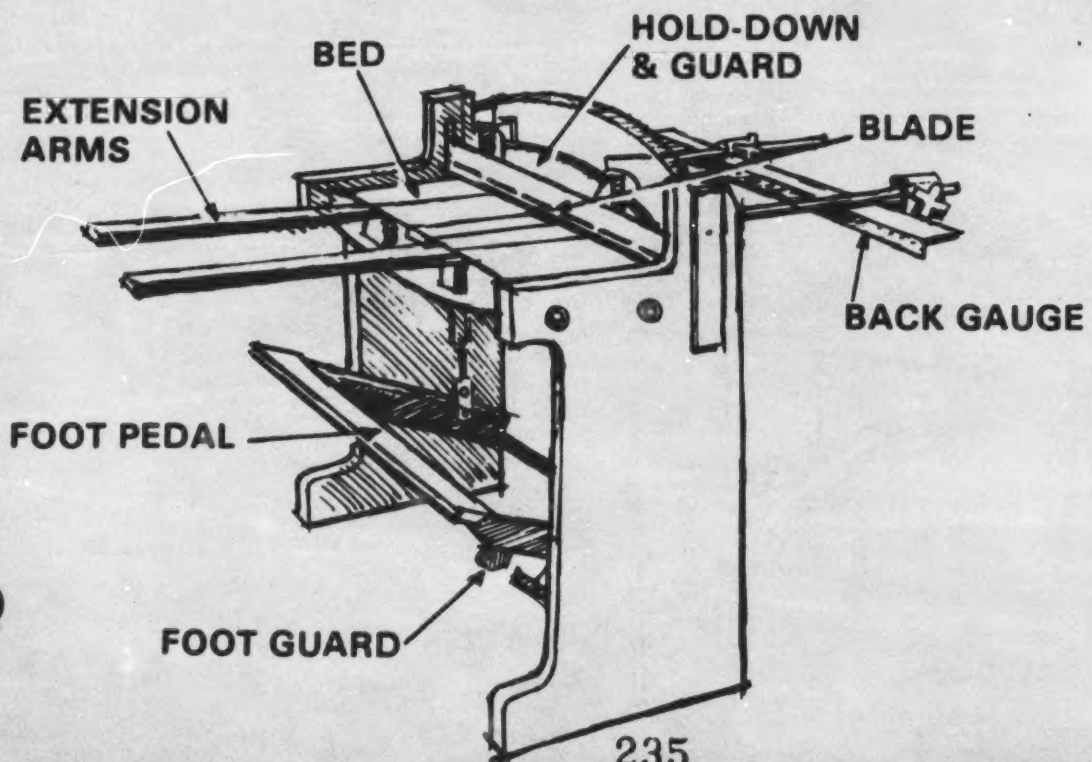
1. There is really no danger zone in front of a spinning lathe. T F
2. The spinning disc or material should never be touched with the hands. T F
3. 2" is the correct working distance between the tool rest and the disc. T F
4. Eye safety protection is not necessary when spinning since there are no chips. T F
5. There is a correct tool for each of the various spinning operations. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Check the machine and the setup before operating. If needed, get a helper.
6. Never exceed the capacity of the machine.
7. Use gloves when handeling large pieces of sheet metal, and remove obvious burrs from all pieces.
8. Keep fingers at least 3" away from pressure bar—hold down-guard—and blade.
9. Do not atempt to catch small pieces, allow them to fall to the floor.
10. Operate only from the front of the machine.
11. Keep area under and around the machine clean and feet out from under the foot pedal.



S

Name _____

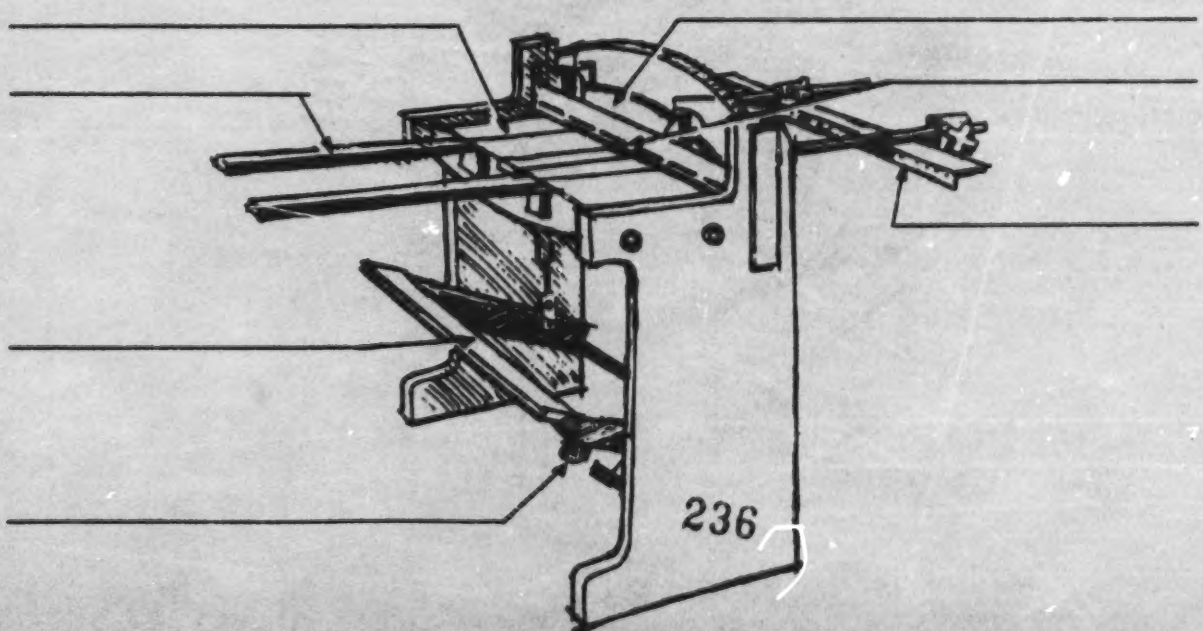
Class _____

Date _____ Grade _____

Safety Quiz

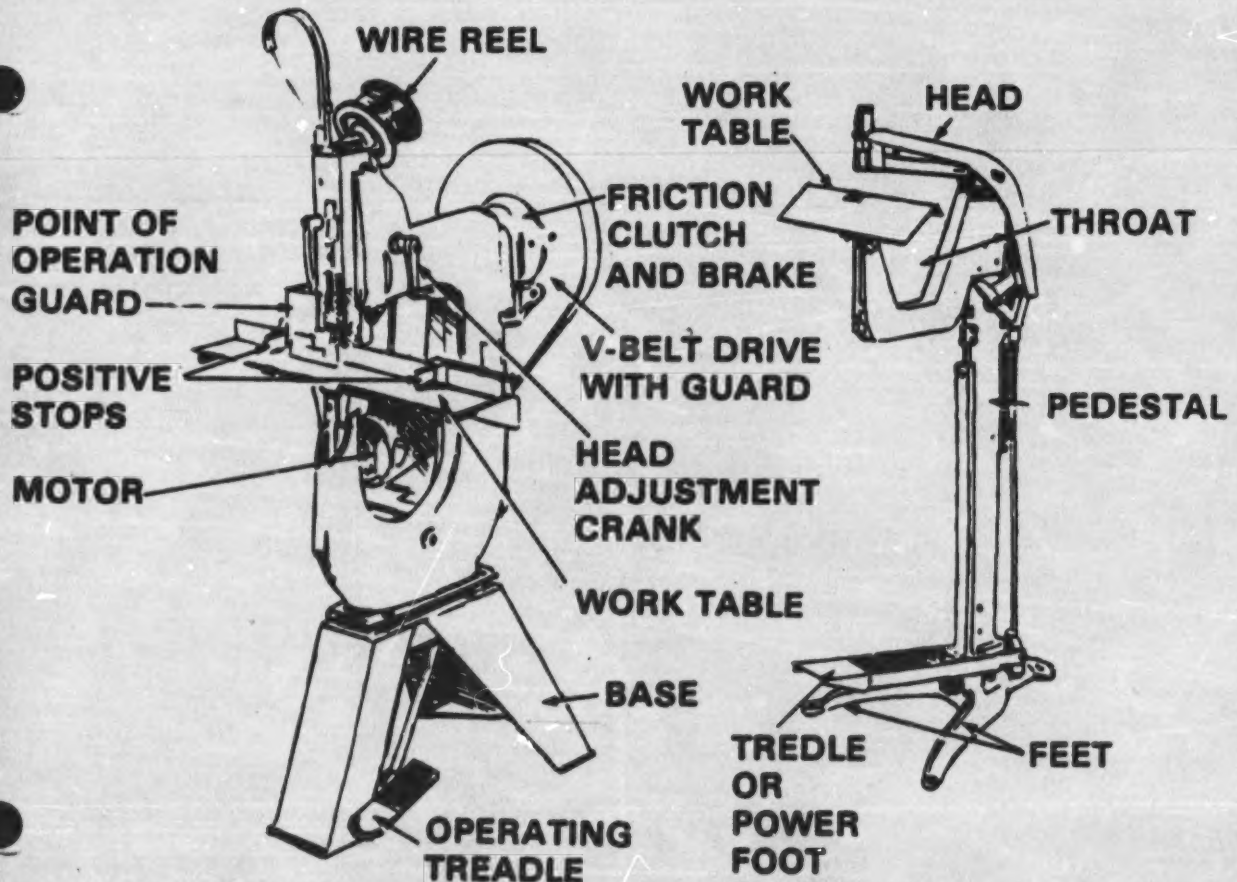
(Circle True or False)

1. Feed and operate from the treadle side of the machine only. T F
2. It is permissible to let small pieces drop into a box as they are cut. T F
3. Two students may operate the shear together. T F
4. For some projects the guard can be removed. T F
5. Gloves can be worn when operating this machine. T F
6. Eye protection is not required. T F



For Safety —

1. Operate only with instructors permission and after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. Be sure power is disconnected on electric driven units when loading or making adjustments.
6. Keep hands clear of stapling or stitching are.
7. Do not exceed the capacity of the unit.
8. Be sure only one individual operates a unit.



Staplier and Stitcher

S

Name _____

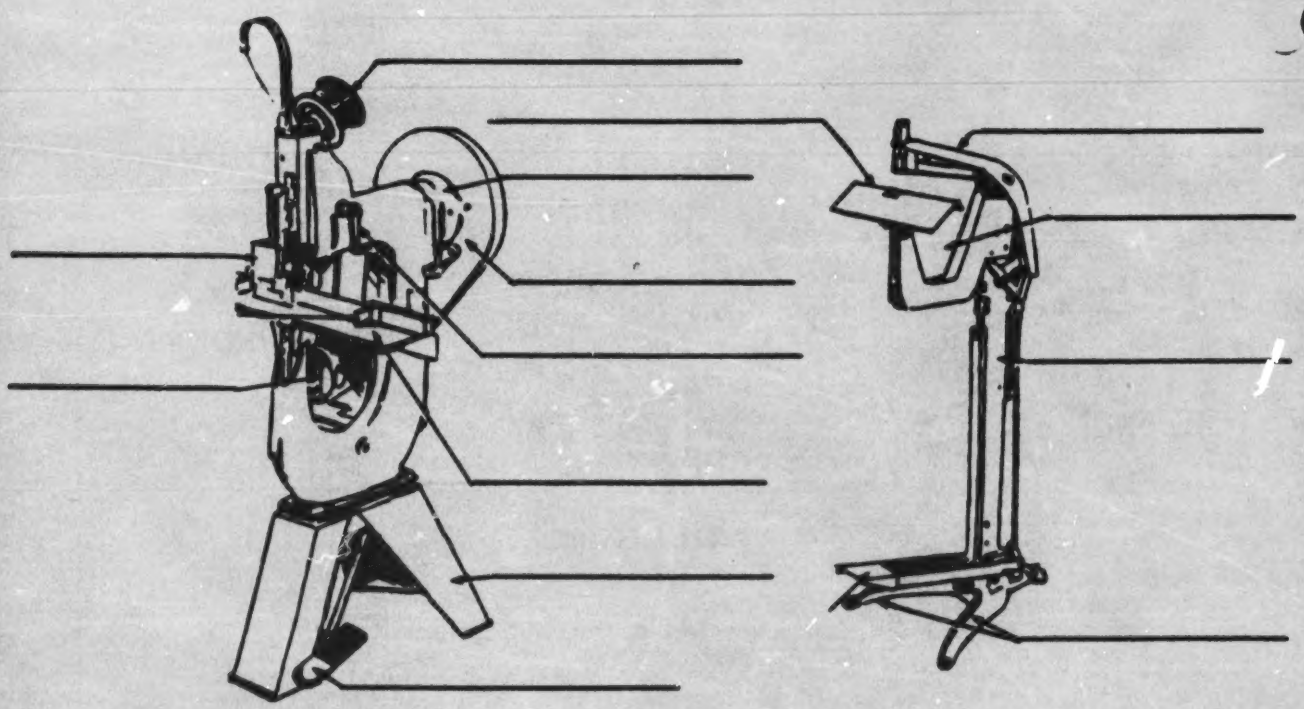
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

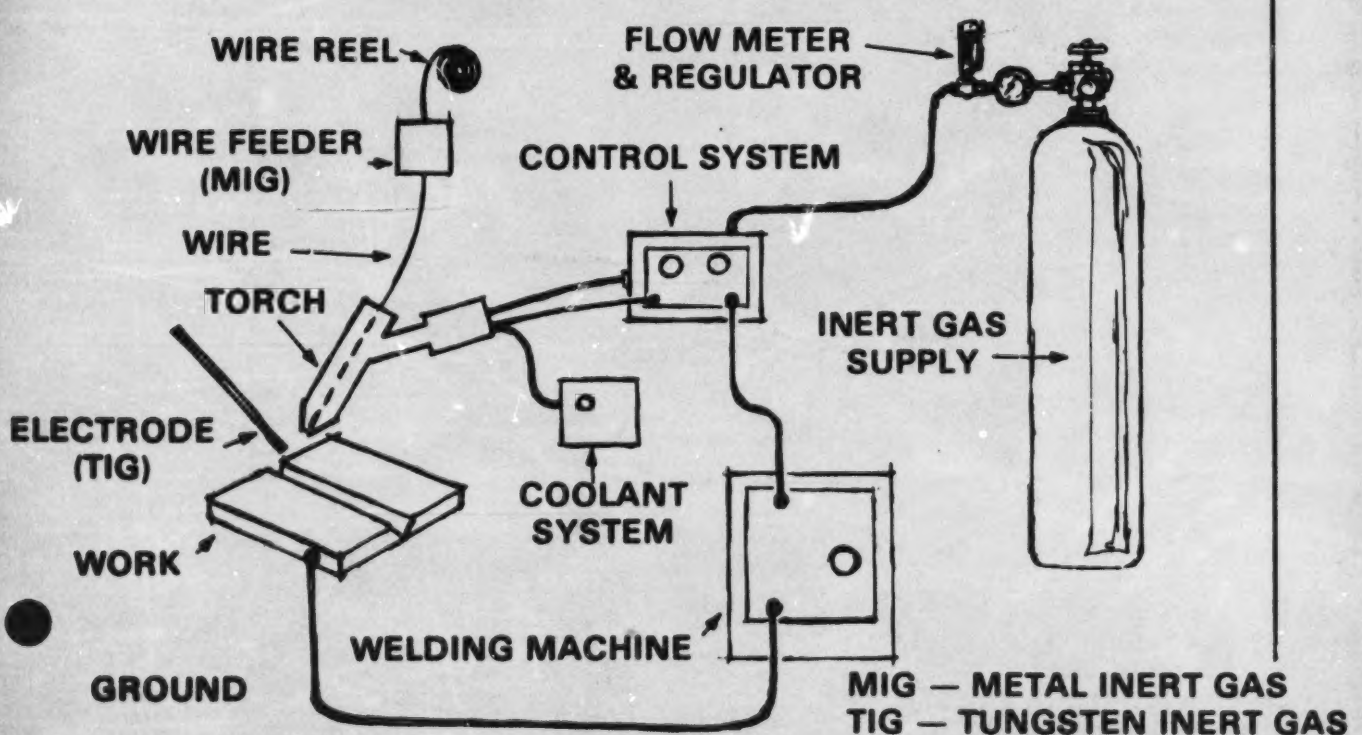
1. Work of any thickness can be stapled or stitched. T F
2. Only one person should operate the unit at one time. T F
3. Minor adjustments can be made with the machine idling under power. T F
4. Hands must be kept clear of the stapeling or stitching area. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Additional protective welding clothing, including a helmet, long sleeve jacket, and gloves must be worn to prevent burns from ultraviolet and infra red rays emitted while arc welding.
6. The helmet used for TIG or MIG welding should be equipped with a minimum number twelve density shade.
7. Be certain that the welder eqiuipped with a high frequency stabilizing unit is installed, maintained, and used according to the recommendations of both the manufacturer and the Federal Communication Commission.
8. Never touch the tungsten electrode or MIG wire while the welder is turned on. It is electrically "hot" and can cause a serious shock.
9. Never use the high frequency when performing shield metal arc (stick electrode) welding.



Name _____

Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

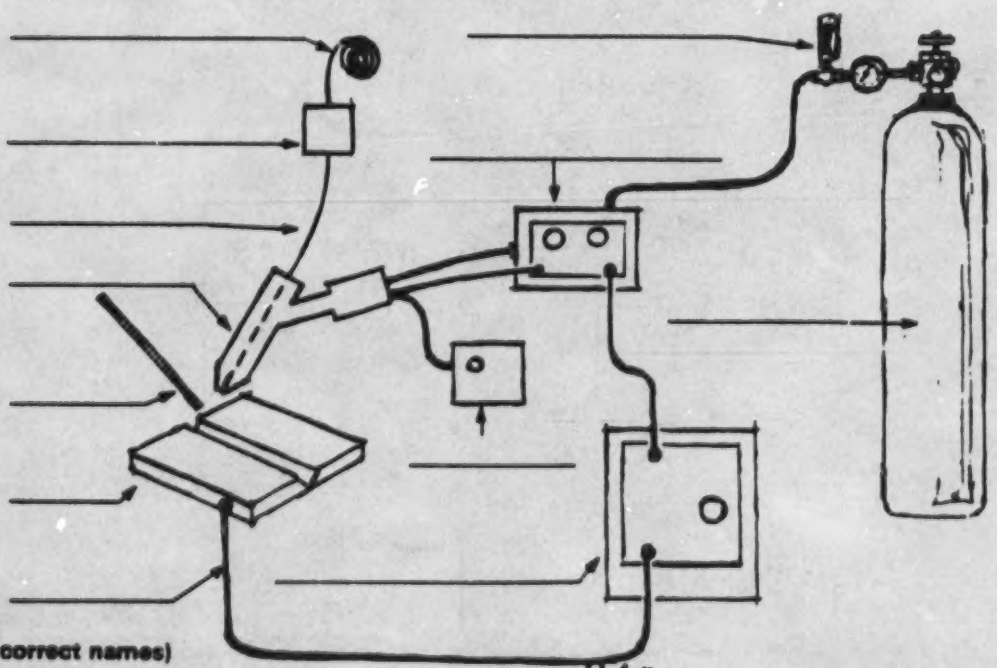
1. High frequency welding units are manufactured according to guidelines established by the Federal Communications Commission. T F

2. It is okay to do Tig or Mig welding without a welding helmet. T F

3. You can be shocked by touching the Tungsten electrode while the Tig welder is turned on. T F

4. The high frequency switch must be turned off while performing regular arc welding. T F

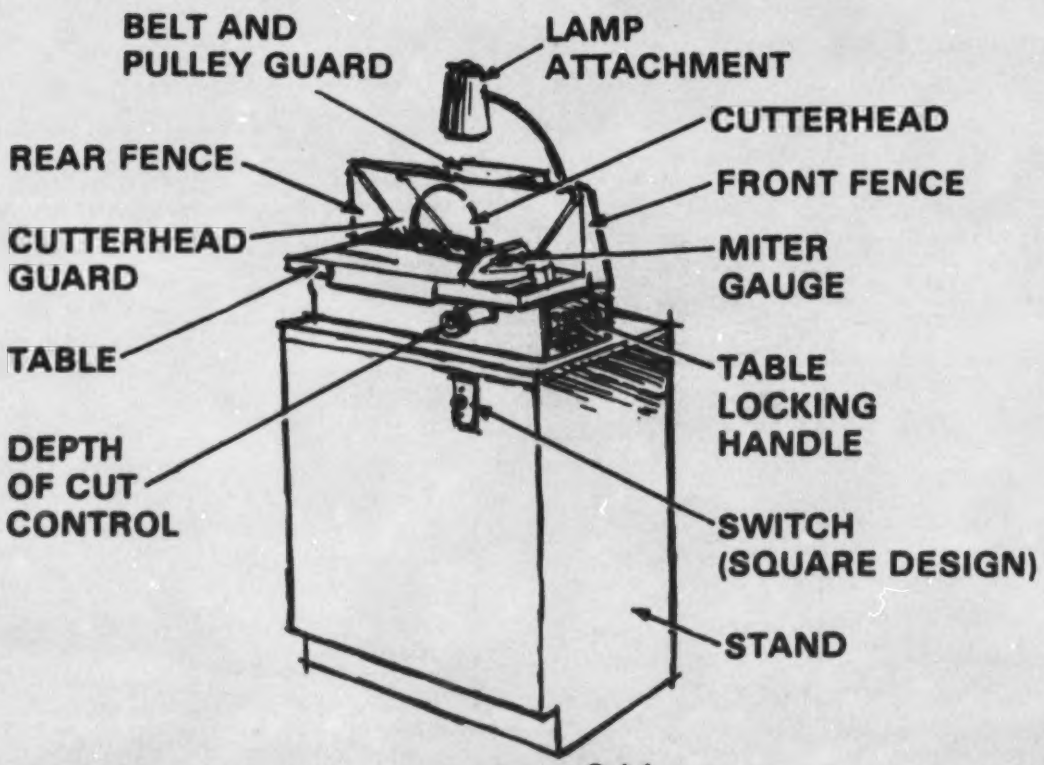
5. Both metal-arc welding and gas shielded arc welding, give off ultra violet and infrared radiation which can burn unprotected skin. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Be sure switch is in off position before adjusting depth of cut, table tilt, or checking cutters.
6. The guard must be clean and slide freely before beginning the operation. Do not clamp in the up position.
7. Always use push stick or a push block when planing small material.
8. Continue moving the work piece past the cutterhead until it is resting against the rear fence.
9. Do not brush chips or dust away from the point of operation until the machine has come to a full stop.



S

Uniplane

Name _____

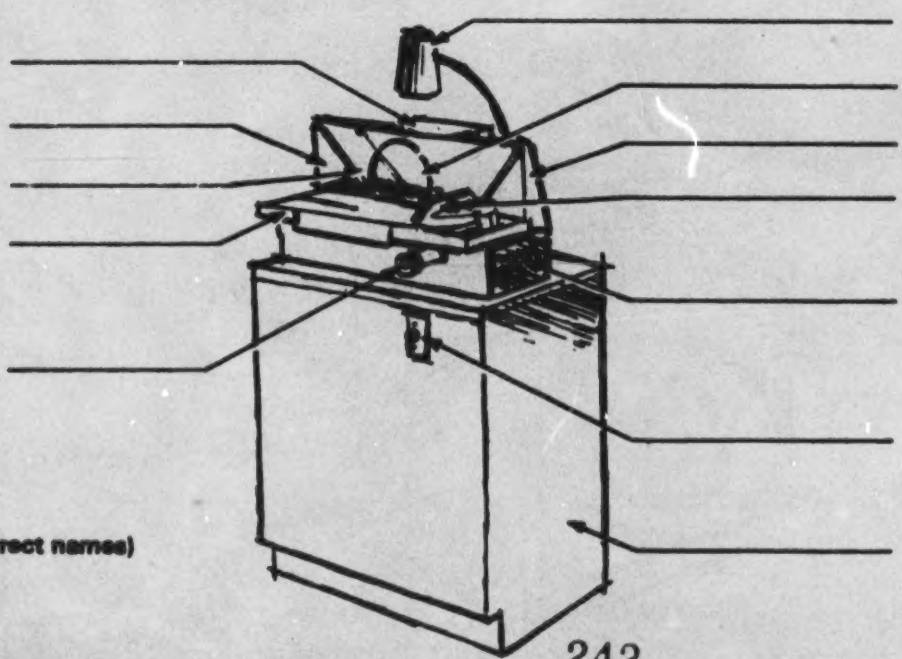
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. The guard should be clamped in position to clear the work piece. T F
2. Loose cutters will give a rough cut but are not detrimental to safety. T F
3. The work piece should be moved through the machine to the rear fence before removing. T F
4. The machine must come to a full stop before it is safe to leave the work area. T F
5. All adjustments should be made with the power off. T F
6. A lamp attachment contributes to safety. T F

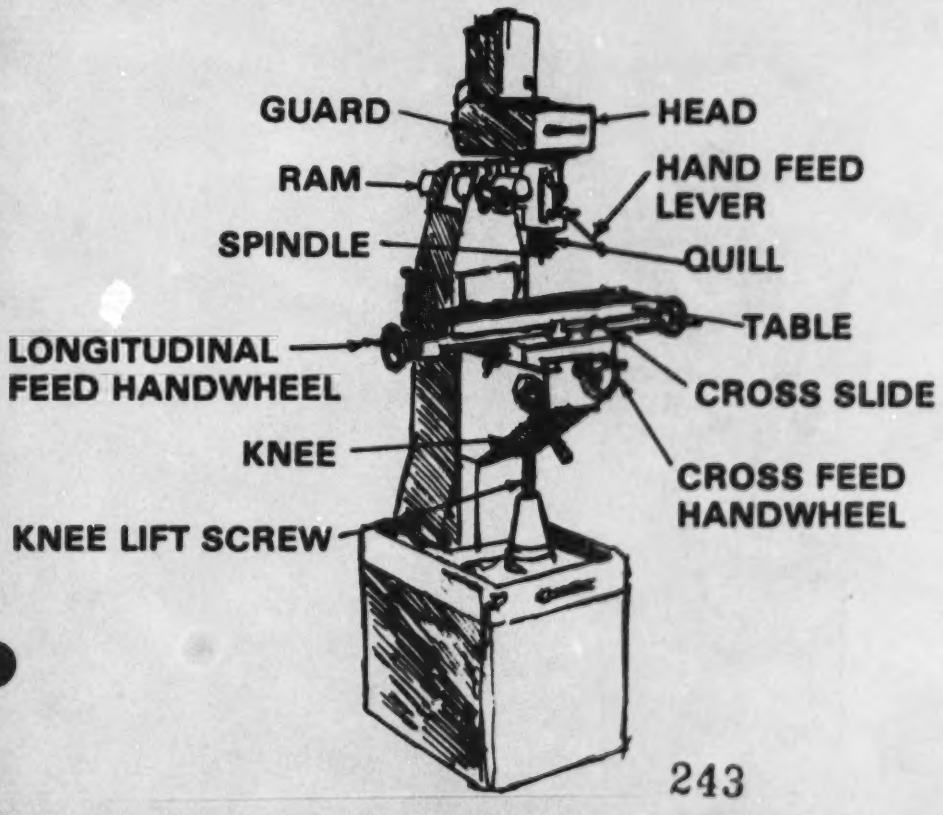


(Print the correct names)

Vertical Milling Machine

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make all adjustments with the power off.
6. Be sure cutter is tightly held in the collet and material is securely held by a vise, clamps, or magnetic chuck.
7. Check spindle rotation, speed, depth of cut and all power feed adjustments before starting the cut.
8. Keep hands away from the cutter. Remove chips with a brush after the machine is turned off.
9. Once a cutting pass is made do not back out or return to the starting position without proper clearance.
10. Remain with the machine for the duration of the cut.



S

Name _____

Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

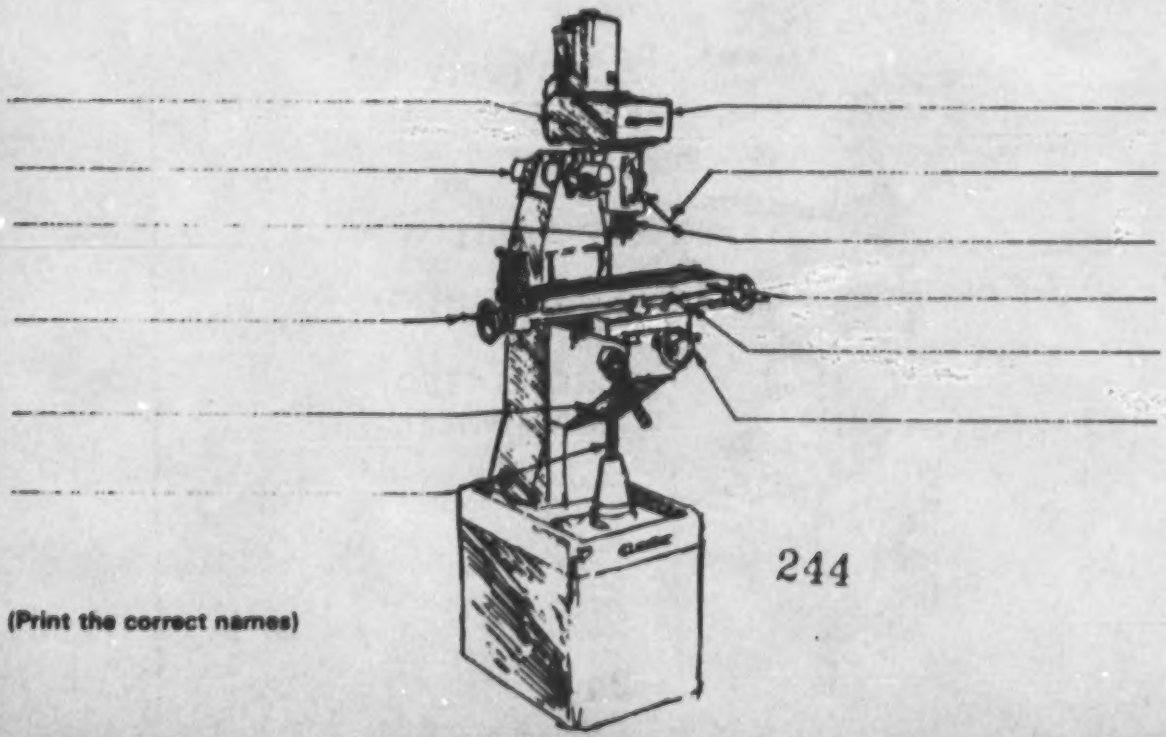
1. If a brush is used it is safe to remove chip while the machine is running. T F

2. All adjustments have to be made with the power turned off. T F

3. If machine is running slow eye protection is not necessary. T F

4. You can back out of a cut at any time without raising the quill or moving the table. T F

5. The work piece must be securely fastened to the table before begining the cut. T F

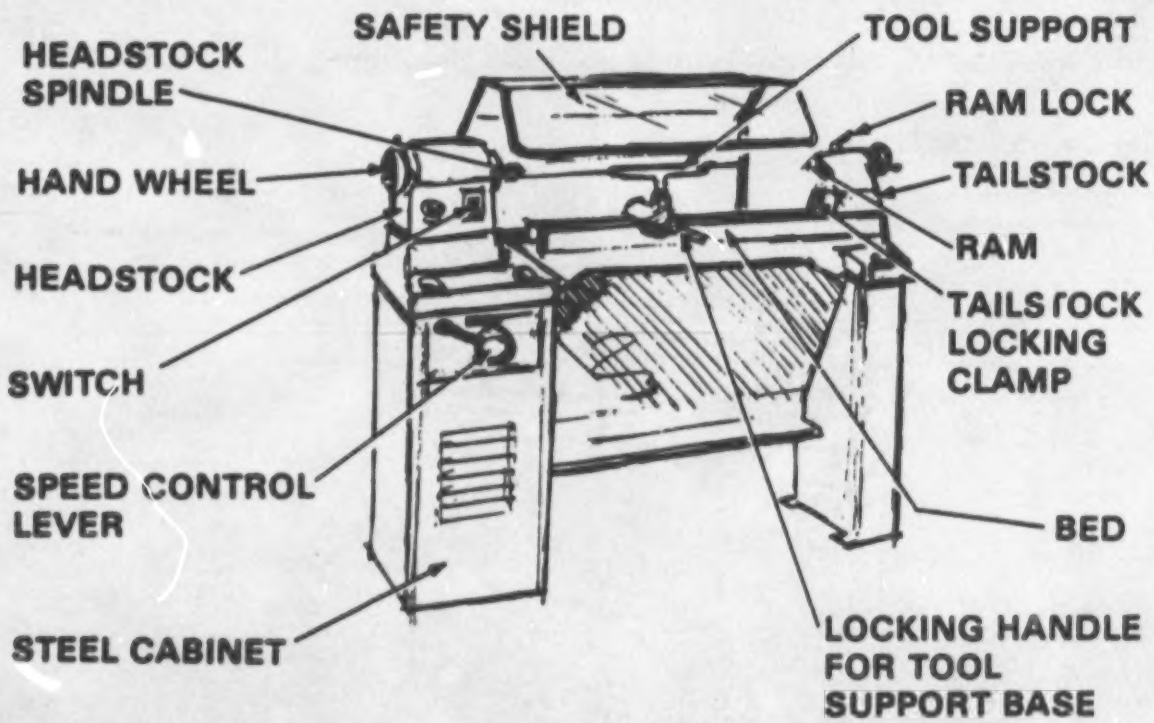


(Print the correct names)

244

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Work must be balanced and securely held between centers or mounted on a face plate.
6. Rotate spindle by hand to check clearance before starting the lathe.
7. Make sure safety shield is lowered.
8. Tool rest must be 1/8" from the work piece and adjusted to the proper height for the tool being used.
9. Be sure the lathe is running at the proper speed for the operation.
10. Remove the tool rest and base or support before sanding or polishing.
11. Make sure lathe cutting tools are sharp and use the correct tool for the operation.



Wood Lathe

S

Name _____

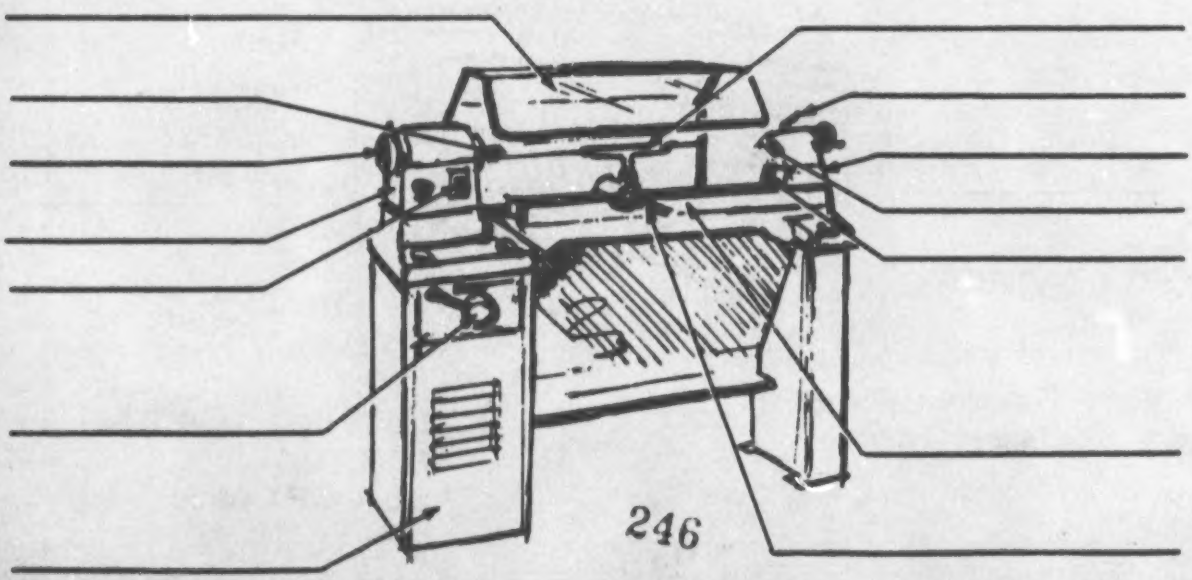
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. The speed of the machine is not important for safe operation. T F
2. A space of 1" is safe between the tool rest and the work. T F
3. Eye protection is not necessary during operation. T F
4. Dull tools may be used for a roughing operation. T F
5. The tool rest should be removed while sanding. T F
6. It is safe to turn work that is not balanced. T F
7. Long sleeves may be worn while operating the lathe. T F
8. The cutting tools should be held loosely. T F

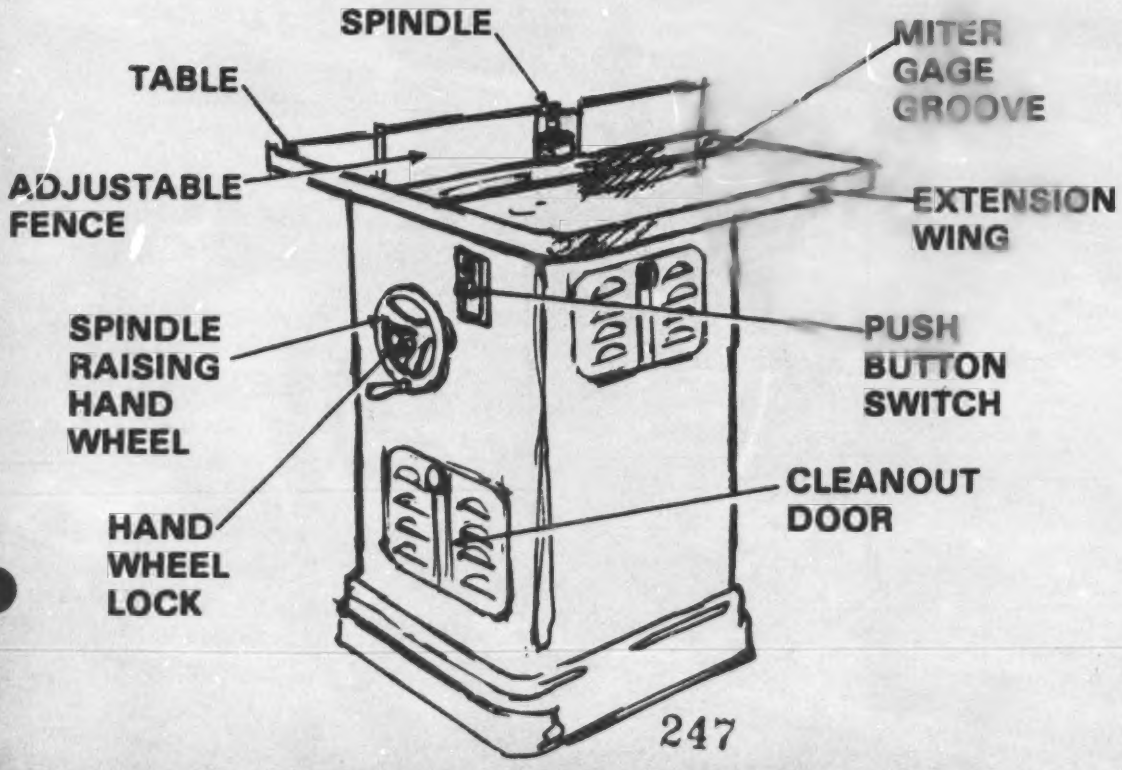


246

(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. All adjustments for cutter heighth and fence position should be made with the power off.
6. Guards and hold downs should be checked for proper operation.
7. Choose the correct cutter and collars for the operation.
8. Expose only the amount of cutter necessary to do the job. Use additional fixtures if necessary.
9. Always use a starting pin for free hand shaping .
10. Use the smallest table insert possible.
11. Use three wing-one piece cutters when ever possible.
12. Brush away dust and chips only when the machine is stopped.



S

Wood Shaper

Name _____

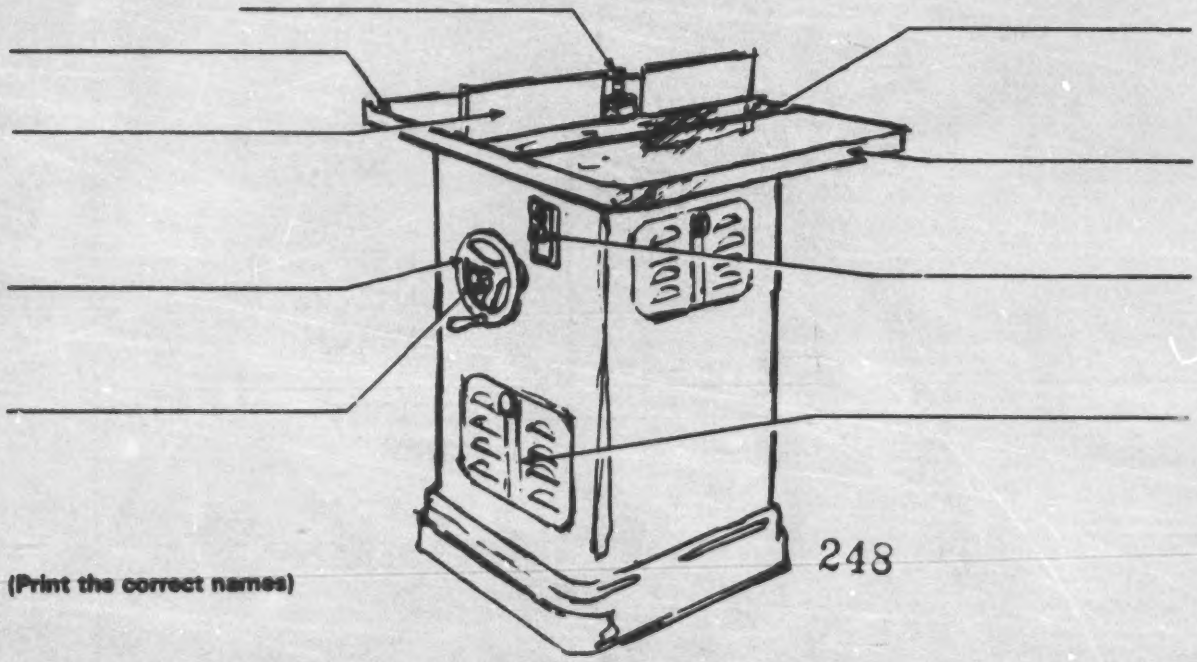
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. In most cases guards and hold downs only get in the way. T F
2. Often special or custom fixtures must be made to do a job safely. T F
3. A starting pin is not necessary. T F
4. The largest table insert should always be used. T F
5. A brush should be used to brush away chips when the machine is running. T F
6. Three wing cutters are safer than a cutter head. T F



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SAFETY RULES FOR PORTABLE ELECTRIC HAND TOOLS

1. Instructor permission must be obtained before using portable electric tools.

2. Be sure that the switch is in the "off" position before you "plug" in the electric cord.

3. Eye protection must be worn when operating <u>all</u> portable electric tools.

4. The switch on each equipment handle should be the constant pressure (dead-man) type. That is, when pressure is released, power is shut off.

5. Be sure that equipment is properly grounded - do not use in wet areas.

6. Do not wear loose or baggy clothing that could be caught in revolving parts.

7. Before starting, be sure that you have a good footing and that your work area is free of obstacles.

8. The electric cord should be inspected for breaks or exposed wires before using.

9. Excessive pressure while operating portable electric tools may damage the tool and cause an accident.

10. All work should be properly secured before applying the tool.

11. Guards should be inspected before starting, to see that they function properly.

12. When portable electric saws are used, care must be taken to avoid cutting through the power supply and extension cords.

13. When portable electric saws are used, the student must avoid "over-reaching" when completing a cut. Work should be positioned and secured in a manner that allows the tool operator to "walk through" the cut safely.

14. Stock must be positioned and secured in a manner that allows cutting without binding of the saw blade of portable circular and bayonet-type saws.

15. Disconnect the cord plug from the power outlet before making any adjustments or replacing a blade or cutter.

16. If an extension cord must be used, make sure it is 12 gauge wire or heavier for lengths up to 100 feet and 10 gauge or heavier for lengths up to 150 feet.

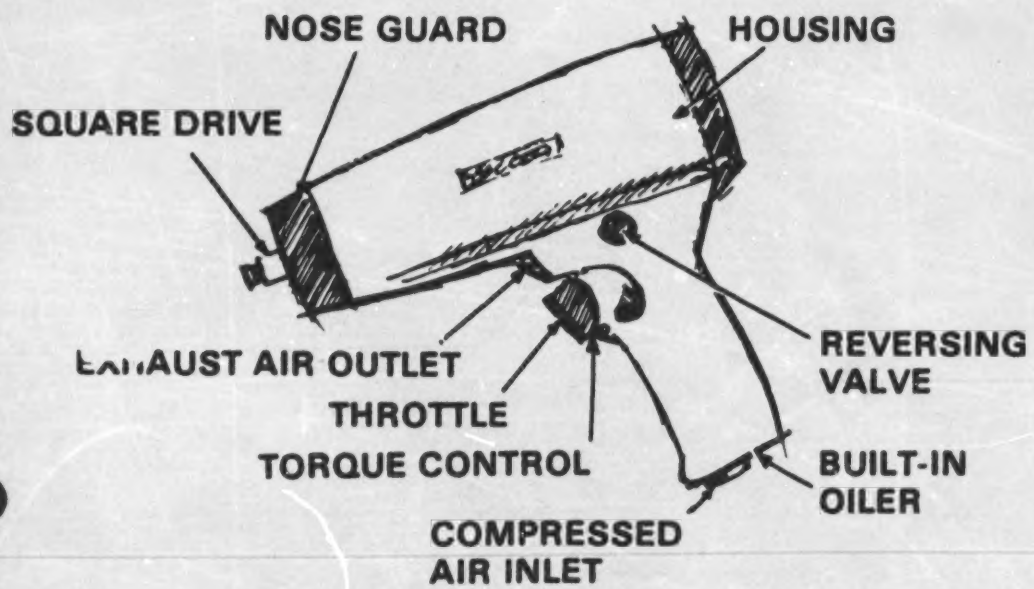
17. Never run a portable electric tool where there is danger of explosion or fire due to the presence of naptha, gasoline, benzene or other inflammable substance.

18. Keep your fingers away from blades or cutters.

Portable Air Impact Wrench

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Be sure throttle is in the off position before connecting to air supply.
6. Always use impact type sockets designed for use with power equipment.
7. Make sure work is secure or held with clamps or tightly in a vise.
8. Set torque control for correct tightness before starting the job.
9. Be sure both hands are free to properly operate an impact tool. Maintain balance and firm footing at all times.
10. Always use the tool in short bursts of power.
11. Quick change coupling should be a end of hose whip, not at the tool.
12. Always disconnect the tool when not in actual use.



Portable Air Impact Wrench

S

Name _____

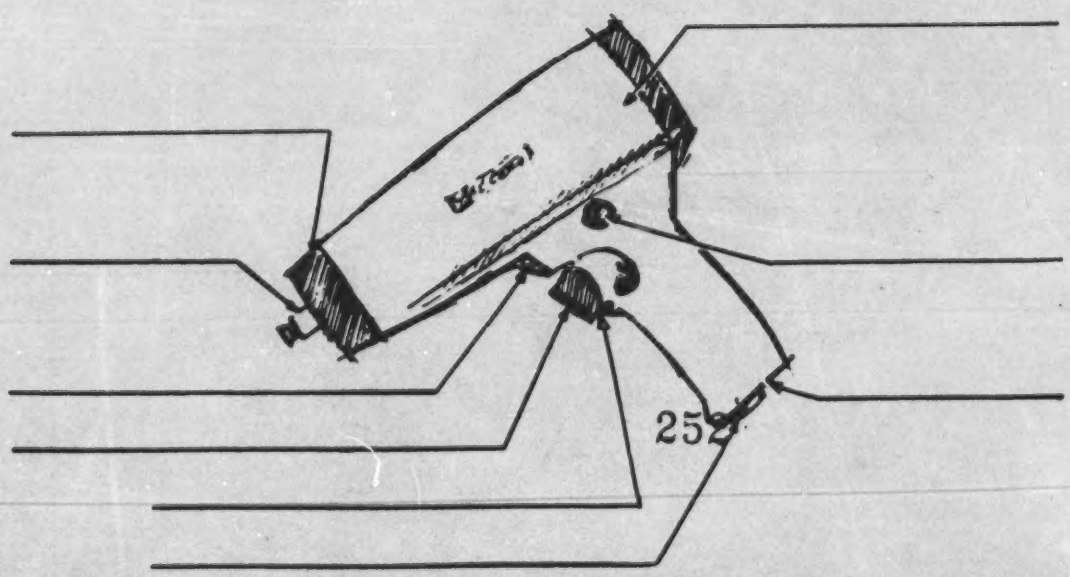
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

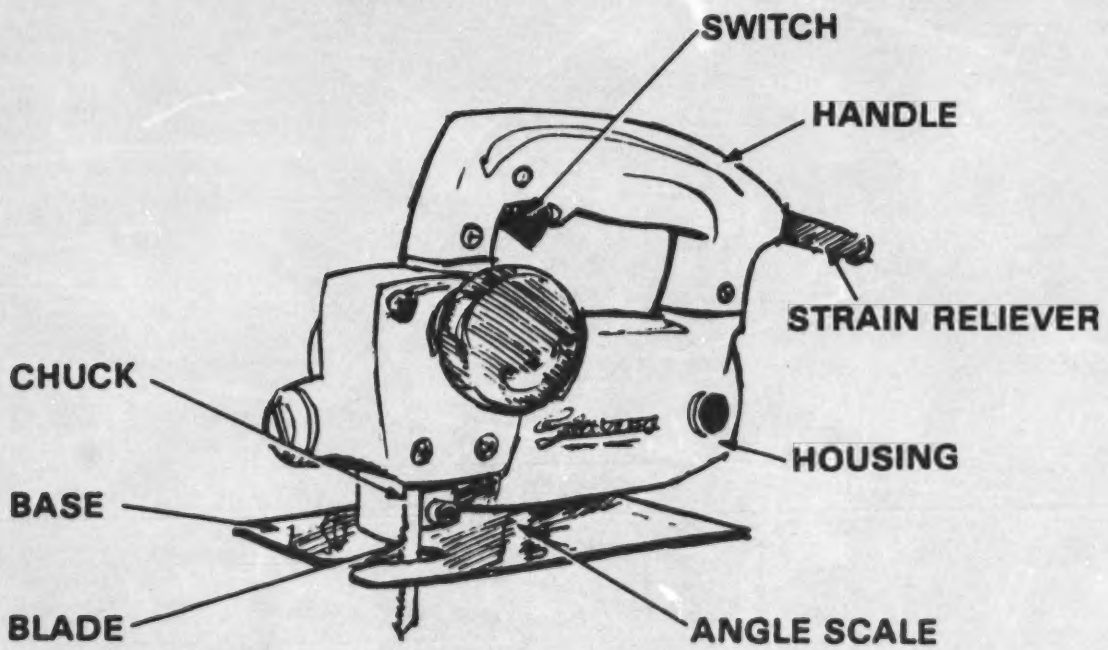
1. It is safe to operate the impact wrench with one hand if the bolt or nut is not too tight. T F
2. Since there are no chips, eye protection is not necessary. T F
3. The sockets used must be designed for impact wrenches. Regular sockets are not adequate. T F
4. The tool should be disconnected from the air line at the end of the hose whip, not at the tool. T F
5. The impact wrench must be disconnected when not in actual use. T F
6. Short bursts of power should always be used to operate the tool. T F



Bayonet Saw

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make sure the blade is the correct type for the material and that it is tightly clamped in the chuck.
6. Be sure the switch is off before connecting to the power source.
7. Use vise or clamps to securely hold material to be cut.
8. Keep cutting pressure constant, do not force the blade into the work.
9. Always keep the base tightly against the material being cut.
10. Do not set the saw down on the bench until it has stopped.
11. If the blade is in the tool be sure and lay the tool on its' side.



S

Bayonet Saw

Name _____

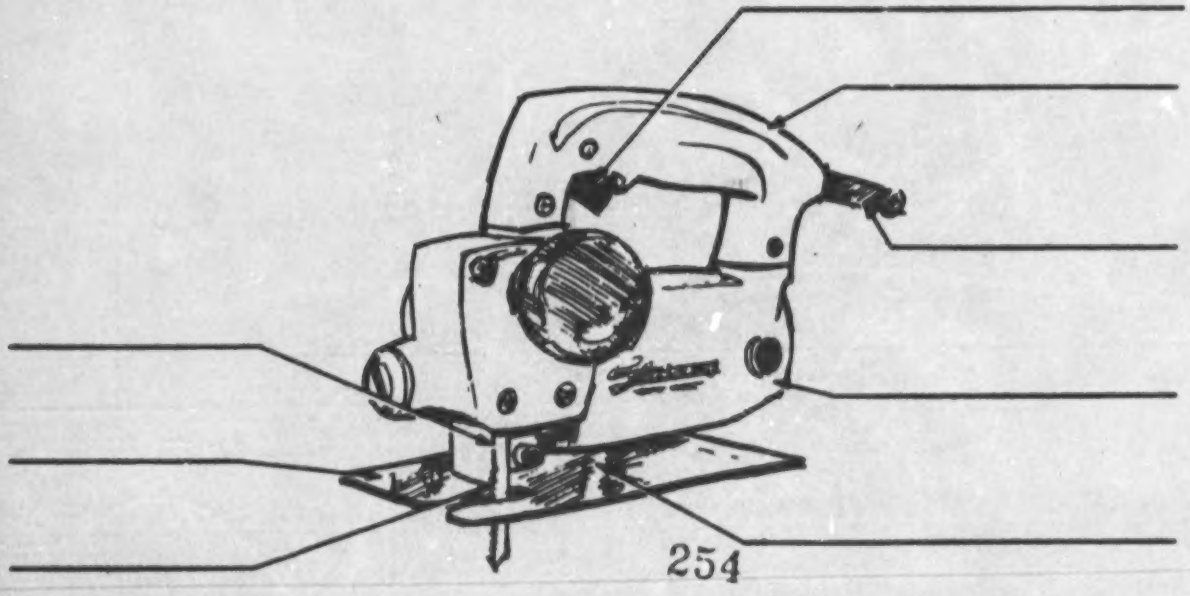
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

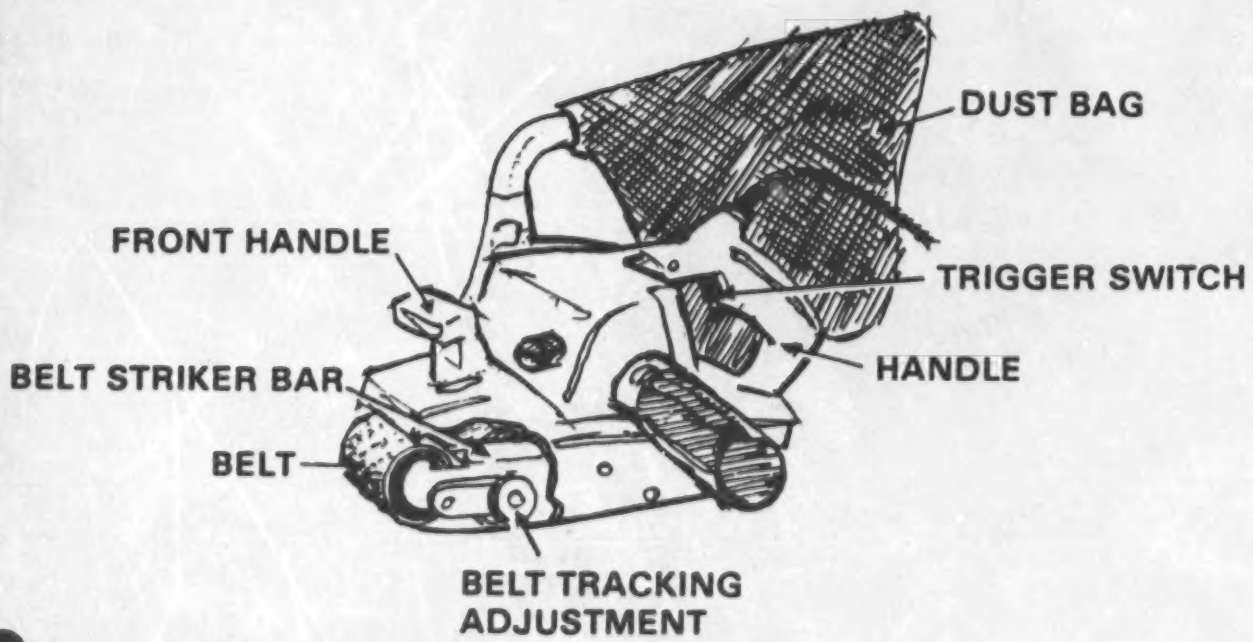
1. Any blade will safely cut any kind of material. T F
2. Material should be held securily before starting to cut. T F
3. Cutting pressure should be constant without forcing the blade into the work. T F
4. The base should always be flat against the work, even when the saw is tilted. T F
5. The saw can be stored using the blade and the rear of the base for support. T F
6. The housing and handle should be kept free of grease, chips and dust. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Check to see if belt is in good condition, tracking properly, and is the correct grit size for the job.
6. Be sure switch is off before connecting to power source.
7. Start sander above work; let rear of belt touch first then level the tool. Do not tilt sideways.
8. Sand in direction of grain moving back and forth over a large area. Do not pause in one spot.
9. Keep electrical cord and dust bag away from working area.
10. Lift sander off the work and wait until it has stopped before placing on the bench.



S

Portable Belt Sander

Name _____

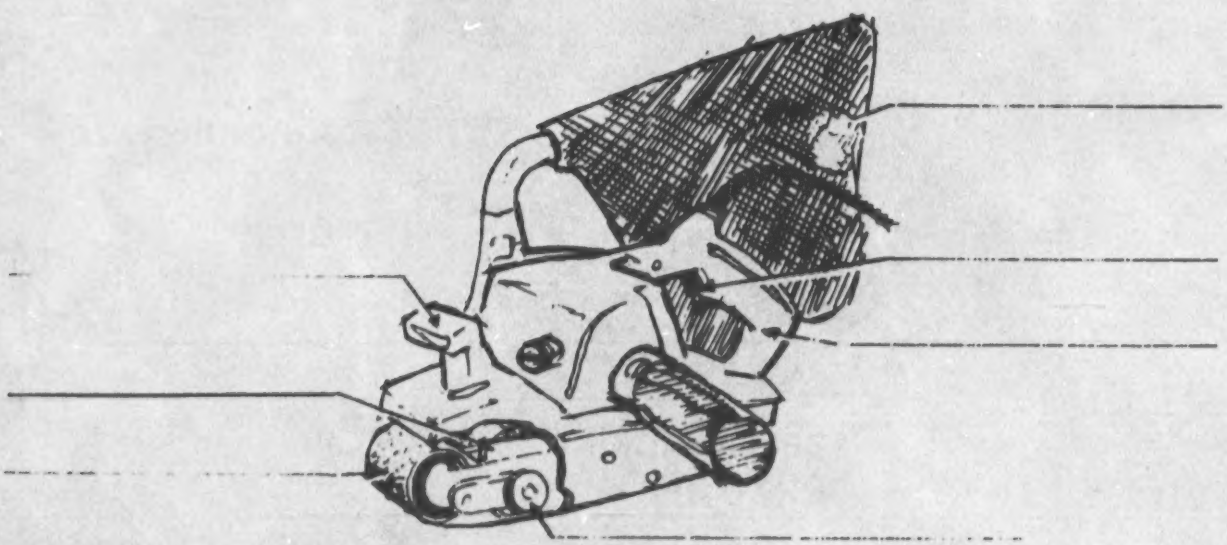
Class _____

Date _____ Grade _____

Safety Quiz

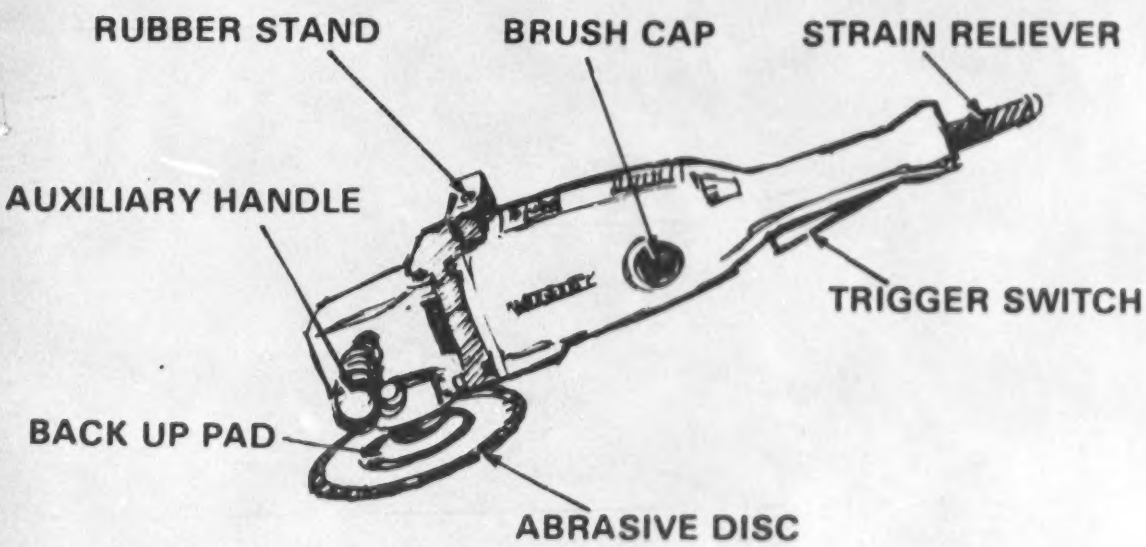
(Circle True or False)

1. Proper belt is not a real factor in safe operation. T F
2. The sander should be resting flat on the work piece when starting. T F
3. If a firm grip is maintained on both handles it is not critical to remove jewelry. T F
4. There is a relation between selecting the correct belt for the job and safety. T F
5. The tool should never be tilted or allowed to pause in one spot. T F



For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
6. Before connecting to the power source be sure the switch is in the off position.
7. Make sure back up pad and disc are securely fastened to the tool. Unplug the sander when changing discs.
8. Do not allow the edge of the disc to touch the edge of the stock.
9. Stand clear of the spark line or spark area.
10. Sand or finish with a stroking motion; do not pause in one spot.
11. Set grinder or sander on back or on rubber stand when not in use and disconnect from power source.



S

Portable Disc Sander

Name _____

Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

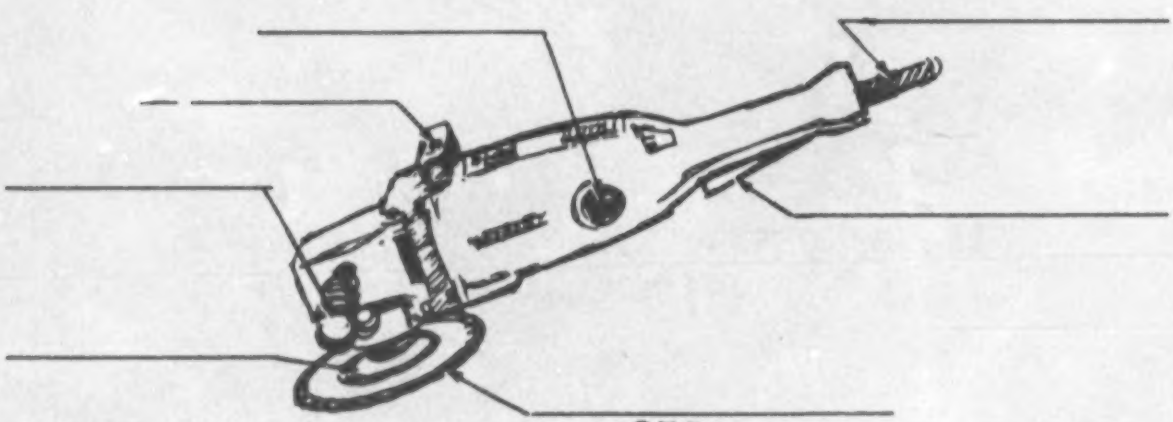
1. The sparks caused by grinding or sanding are warm but not dangerous. T F

2. In order to remove material fast it is safe to grind steady in one spot. T F

3. It is advisable to wear protective clothing while using this tool. T F

4. A fast rolling action takes place when the edge of the disc touches the edge of the stock which can throw the grinder or sander. T F

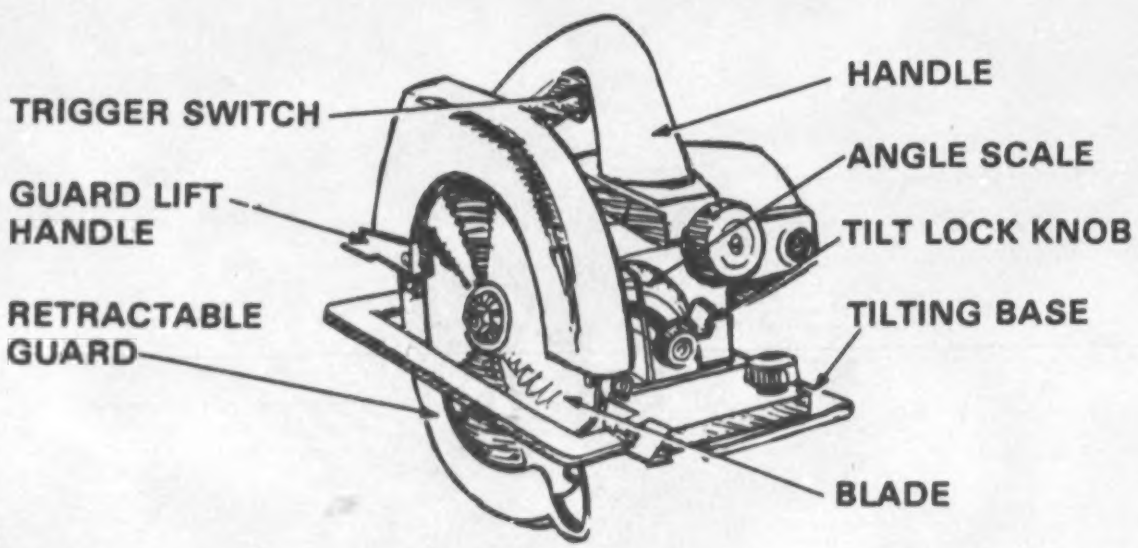
5. The grinder or sander should be unplugged and set on its' back when not in use. T F



Portable Electric Circular Saw

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Make sure that telescoping guard returns automatically to cover the blade after each cut.
6. Check the base setting for the proper depth of cut.
7. Make sure the power cord is clear of the blade.
8. Be sure the material you are cutting is adequately supported.
9. Do not start the cut until the saw has reached full speed.
10. Advance the saw slowly, straight through the work. Do not twist or turn the tool.
11. If the saw blade binds or smokes, stop cutting immediately.
12. The blade should be extended below the work until the blade Gullets clear the material.
13. Do not set saw down until blade stops.



S

Portable Electric Circular Saw

Name _____

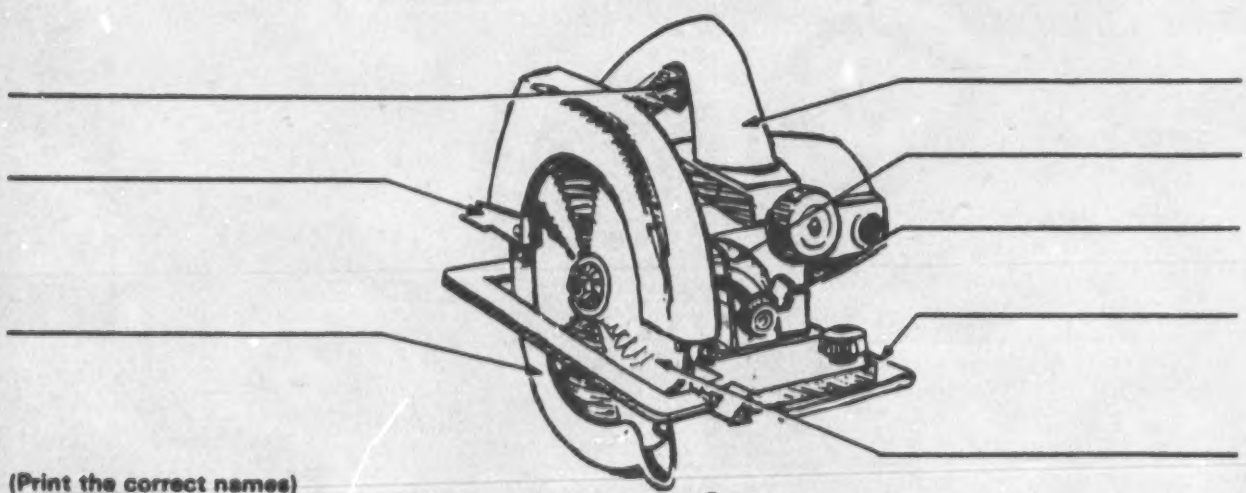
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

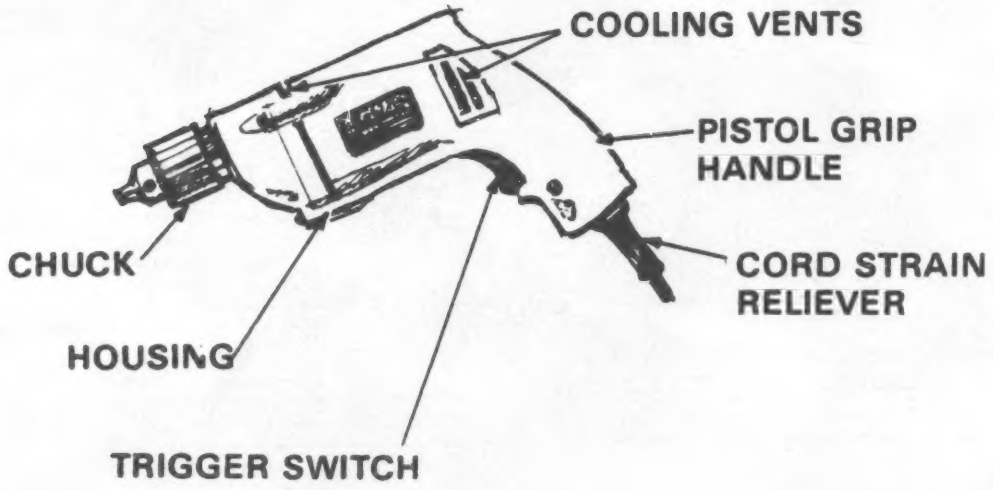
1. Permission should be obtained before operating this machine. T F
2. In certain cases the guard should be wedged so that it will not be operable. T F
3. Eye protection is not necessary when using this machine. T F
4. You should not set the saw down until it has completely stopped. T F
5. The saw blade should extend at least 1" beyond the thickness of the material being cut. T F
6. This saw can safely be used for cutting curves. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. "Unplug" the drill when changing bits.
6. Make sure switch is off and key removed before connecting to power source.
7. Mark hole location with center punch (metal) or AWL (wood) before drilling.
8. Be sure work is tightly clamped or secure before drilling.
9. Drill with straight even steady pressure.



S

Portable Electric Drill

Name _____

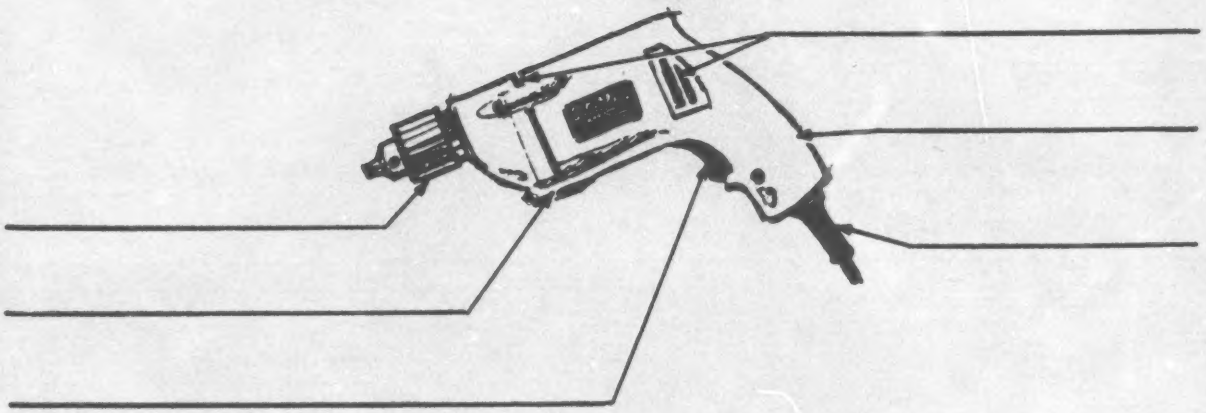
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

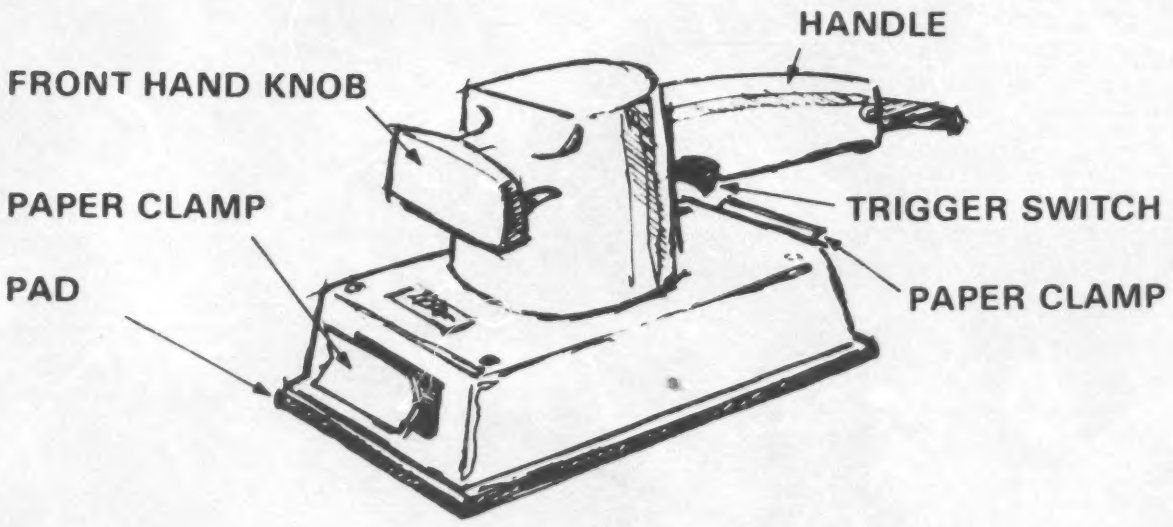
1. Eye protection is not really necessary when drilling wood. T F
2. The drill should be unplugged when changing bits. T F
3. It is alright to carry the drill by the cord. T F
4. Even steady pressure should be used when drilling. T F
5. Work should be clamped while drilling. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Be sure switch is in off position before connecting to the power source.
6. Make sure abrasive sheet is in good condition and properly installed on the tool.
7. Start the tool above the work, set it down evenly and move slowly over a wide pattern area.
8. Lift the sander from the work before stopping the motor.
9. Do not set the sander on the work bench until it has stopped running.
10. Never lift or carry any portable electric tool by the power cord.



Portable Electric Finishing Sander

Name _____

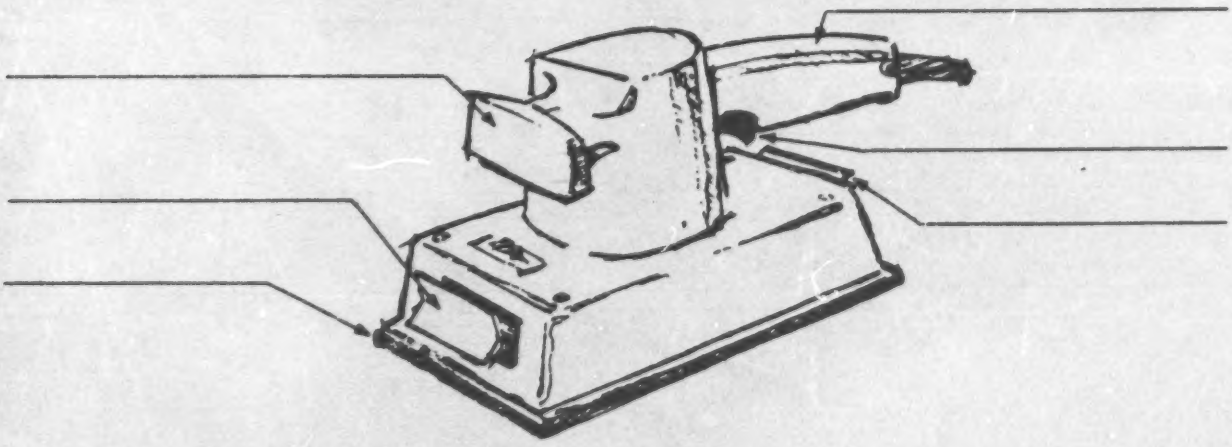
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. Eye protection must be worn when using the sander. T F
2. The abrasive sheet can be loosely clamped yet still be be safe and efficient. T F
3. The sander should never be carried by the power cord. T F
4. The tool should be turned on only after it is placed tightly on the material to be sanded. T F
5. Lift the sander from the work before turning it off. T F



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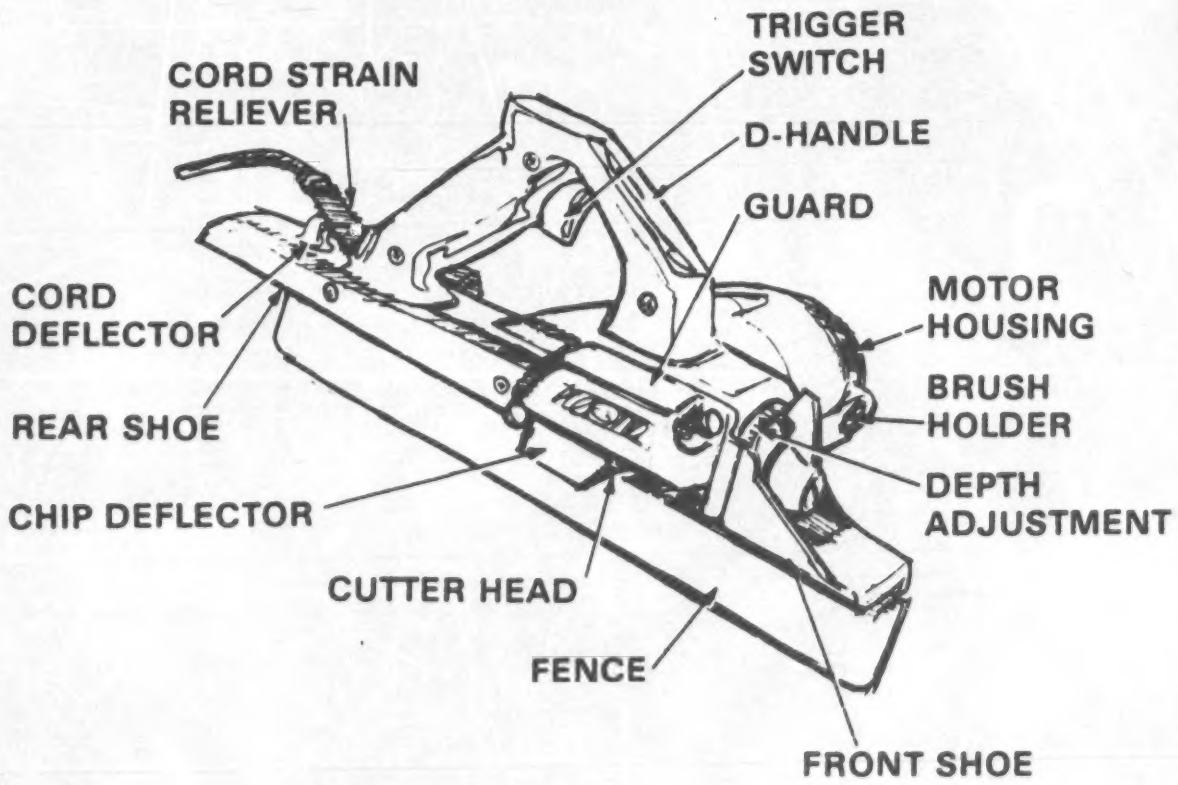
(...it the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Before connecting to the power source make sure the switch is in the off position.
6. Make all adjustments with the plane disconnected from the power source.
7. Place front shoe on the work piece, start motor, then more plane over work keeping pressure and speed constant.
8. Keep fence and the rear shoe tightly against the work piece until the cutter has cleared the work.
9. Keep hands on handle and motor housing, away from the cutter head.
10. Be sure of clearance for the motor.



Portable Electric Plane

S _____

Name _____

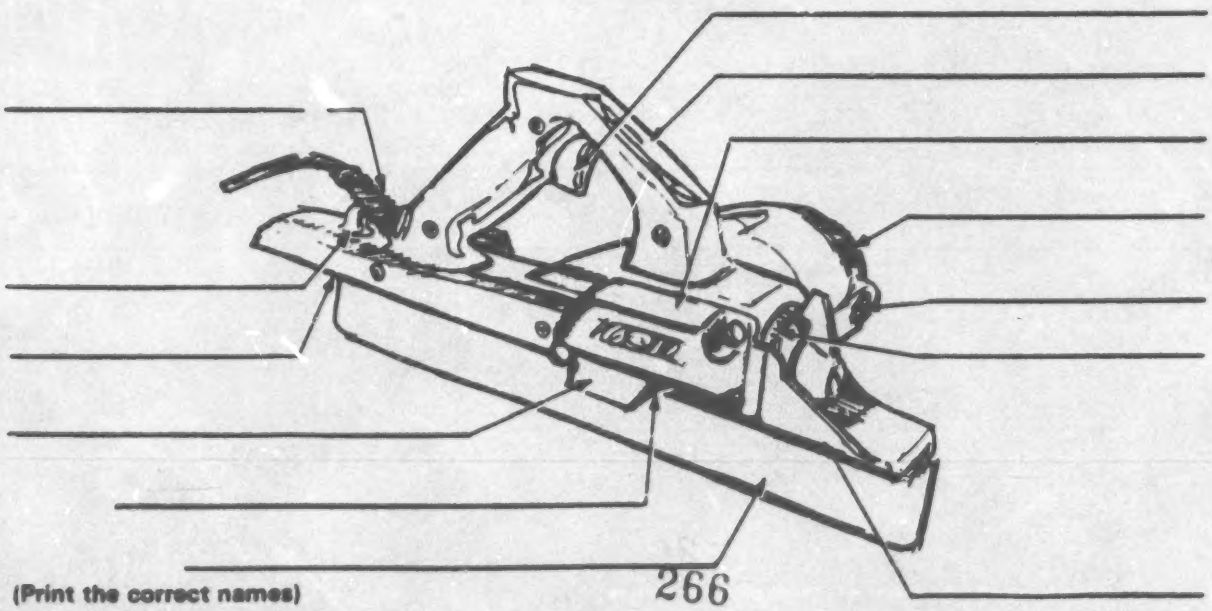
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

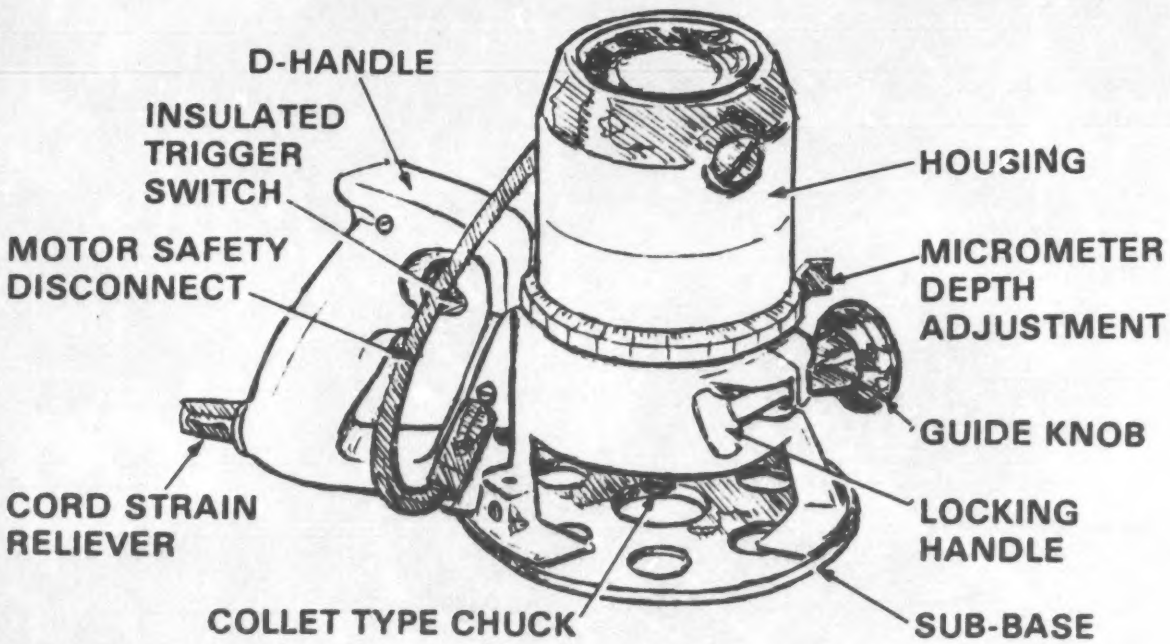
1. Since the cutter will not touch, it is alright to set the plane on the bench while still running. T F
2. The plane will cut deeper the more pressure is applied. T F
3. The plane should be disconnected before adjusting the depth of cut or the fence. T F
4. Eye protection is required when using a power plane. T F
5. The plane should be kept firmly against the work piece until the cut is completed. T F
6. The chip deflector is of no real safety value and can be removed. T F



(Print the correct names)

For Safety —

1. **Operate only with instructors permission and after you have received instruction.**
2. **Remove jewelry, eliminate loose clothing, and confine long hair.**
3. **Make sure all guards are in place and operating correctly.**
4. **Always use proper eye protection.**
5. Be sure switch is off before inserting plug into power source.
6. Be sure collet chuck is tight and bit is secure.
7. Make sure work piece is clamped or rigidly held and the area of router travel is free of obstructions.
8. Hold router with both hands and cutting pressure should be constant. Do not force or jam into work.
9. Make a trial cut in a piece of similar scrap material.
10. Disconnect from power source when changing bits, making adjustments, or when router is not in use.



S

Portable Electric Router

Name _____

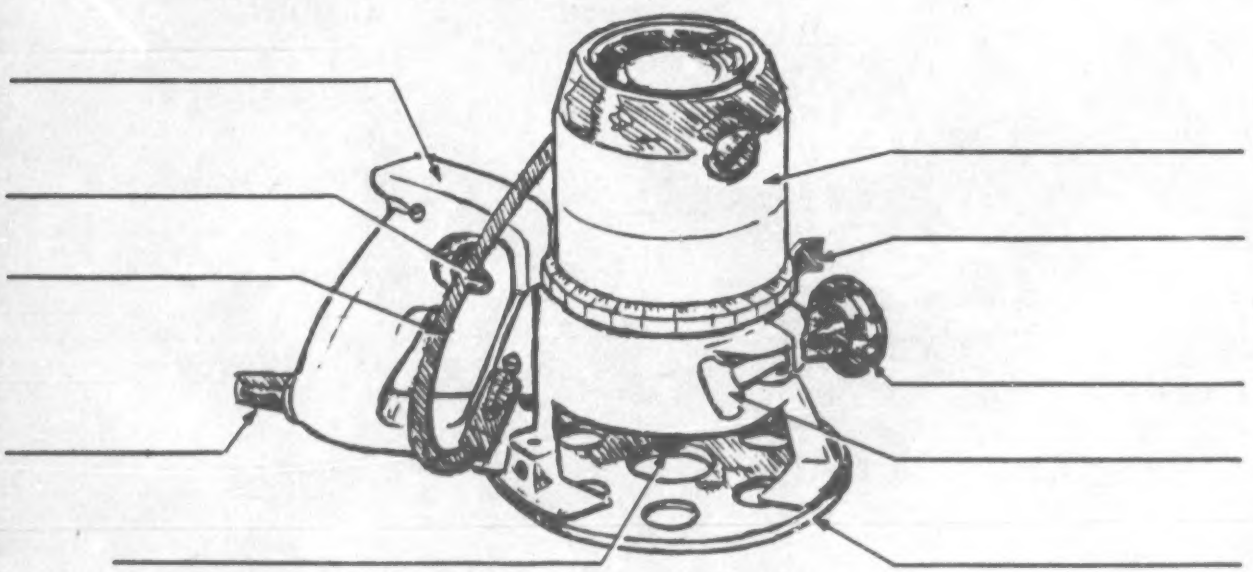
Class _____

Date _____ Grade _____

Safety Quiz

(Circle True or False)

1. It is a good idea to make a trial cut in a piece of scrap wood. T F
2. A router should always be held with both hands. T F
3. A jogging motion should be used when cutting to keep the bit cool. T F
4. It is not necessary to clamp material being routed. T F
5. The depth of cut may be safely adjusted without unplugging the tool. T F
6. The router is not really guarded. T F



(Print the correct names)